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ENDOUROLOGY

Original Article

# Comparative outcomes of plasmakinetic versus monopolar transurethral resection of benign prostatic hyperplasia: 7 years' results

## *Benign prostat hiperplazisi nedeniyle uygulanan plazmakinetik ve monopolar transüretral rezeksiyonun 7 yıllık karşılaştırmalı sonuçları*

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**ABSTRACT**

**Objective:** We compared results from the standard monopolar or the bipolar plasmakinetic method for the transurethral resection of the prostate (TURP) due to benign prostatic hyperplasia (BPH) at 4 and 7 years after surgery (medium to long term).

**Material and methods:** A retrospective analysis was performed on the complete data from 124 patients who were alive and had 7 years of regular follow-up. Of those 124 patients with BPH, 65 (52%) underwent monopolar TURP (M-TURP) and 59 (48%) underwent plasmakinetic TURP (P-TURP). During the follow-up period, the International Prostate Symptom Score (IPSS), the maximal flow rate (Qmax) measured using uroflowmetry and the prostate specific antigen (PSA) values were recorded. Patients in whom alpha blockers were administered due to the growth of postoperative adenoma and who had been operated on due to urethral stricture, bladder neck contracture or a growing adenoma were also noted and recorded.

**Results:** There was no statistically significant difference between M-TURP and P-TURP groups in any pre-operative or post-operative follow-up parameter at 4 or 7 years post-surgery. Specifically, PSA, IPSS and Qmax values; urethrotomies performed; alpha-blocker use; and the frequency of re-operations were statistically insignificant ($p>0.05$).

**Conclusion:** Our study demonstrated that when medium-to long-term results are compared, P-TURP and M-TURP appear to result in similar IPSS scores, Qmax values, complication rates and retreatment rates. Larger prospective studies are required to corroborate these results.

**Key words:** Monopolar; plasmakinetic; prostate; transurethral resection.

**ÖZET**

**Amaç:** Benign prostat hiperplazisi (BPH) nedeniyle uygulanan Transüretral Rezeksiyonda (TURP), standart monopolar ve bipolar plazmakinetik yöntemlerin 4-7 yıllık (orta-uzun dönem) sonuçlarını karşılaştırmayı amaçladık.

**Gereç ve yöntemler:** Halen hayatta olan ve 7 yıl boyunca düzenli olarak takiplere gelen 124 hasta retrospektif olarak değerlendirildi. BPH'sı olan yüz yirmi dört hastanın 65'ine (%52) monopolar TURP (M-TURP), 59'una (%48) bipolar plazmakinetik sistem ile TURP (P-TURP) uygulandı. Takip sırasındaki Uluslararası Prostat Semptom Skoru (IPSS) değerleri, üroflowmetri ile ölçülen maximal akış hızları (Qmax) ve prostat spesifik antijen (PSA) değerleri kaydedildi. Aynı zamanda; post operatif dönemde büyüyen adenom nedeniyle alfa-bloker kullanan hastalarla, üretra darlığı-mesane boynu darlığı-büyüyen adenom nedeniyle opere olan hastalar kaydedildi.

**Bulgular:** M-TURP ve P-TURP yapılan her iki grupta; ameliyat öncesinde ve sonrasındaki birinci, dördüncü, yedinci yıl takip parametreleri (PSA, International Prostate Symptom Score (IPSS), maximal flow rate (Qmax) değerleri) açısından, alfa bloker kullanımı, üretrotomi uygulanması ve yeniden operasyon gereksinimi açısından anlamlı farklılık saptanmadı ($p>0,05$).

**Sonuç:** Çalışmamızda M-TURP ve P-TURP yapılan hastaların orta-uzun dönem sonuçları karşılaştırıldığında, IPSS skorları, Qmax değerleri, komplikasyon oranları ve yeniden tedavi gereksinimi oranları açısından benzer veriler elde edilmiştir. Bu sonuçları doğrulamak için büyük prospektif çalışmalara ihtiyaç vardır.

**Anahtar sözcükler:** Monopolar; plazmakinetik; prostat; transüretral rezeksiyon.

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## Introduction

Transurethral resection of the prostate (TURP) is the most common endoscopic surgical method used in patients with benign prostatic hyperplasia (BPH), and it remains the gold standard. TURP improves urine flow rate and patient symptoms with a success rate of 85-90%.[1] Morbidity is observed in up to 20% of all TURP procedures. Bleeding necessitating transfusion (2-5%), TUR syndrome (2%), bladder-neck contracture (4%), urethral stricture (3.8%), incontinence (2.2%), erectile dysfunction (6.5%), retrograde ejaculation (65-70%), irritating voiding symptoms and urinary tract infections are complications of TURP.[2,3]

These complications occur in varying proportions depending on the patient's age, the presence of co-morbid diseases, and the surgeon's experience. New technologies have been developed to prevent these complications. Bipolar technology involves a modified monopolar TURP and is designed to prevent these morbid events. The plasmakinetic method, which uses a bipolar device, has been used with increasing frequency over the last 10 years. The system functions like a standard TURP; however, the use of normal saline solution (NaCl 0.9%) instead of hyponatremic glycine during the procedure reduces morbidity associated with fluid absorption and enables resection over a long period. Thus, the risk of electrolyte imbalance and development of preoperative TUR syndrome are eliminated.[4-6]

There are many publications comparing monopolar TURP and plasmakinetic TURP in the literature. The results after a 1-year follow-up were first reported in a prospective randomized trial in 2007, and the study compared standard monopolar and bipolar TURP using the plasmakinetic method.[7] In the present study, results after 4 and 7 years (medium-to-long-term) of follow-up are presented.

## Material and methods

Between January 2000 and December 2005, TURP surgery was performed in 485 men with BPH. The procedures were performed by three surgeons who were consultant urologists and who had similar experience levels in performing TURP. A retrospective analysis was performed of 124 patients who had completed all regular follow-up procedures and were alive after 7 years of follow-up. After obtaining patient consent, monopolar TURP (M-TURP) had original been performed in 65 patients and plasmakinetic TURP (P-TURP) had originally been performed in 59 patients.

Eligibility criteria were: an International Prostate Symptom Score (IPSS) ≥18, failed medical therapy, recurring urinary retention, and maximal flow rate (Qmax) ≤15 mL/s. Exclusion criteria were documented or suspected prostate cancer (high PSA, abnormal digital rectal examination), a history of prostate surgery, bladder stone or diverticulitis, urethral stricture, neurogenic bladder or a prostate volume <30 $cm^3$.

After obtaining a detailed history of symptoms upon initial admission, both systemic and digital rectal examinations were performed. In addition, a complete blood count was obtained, and serum urea, creatinine, electrolyte and PSA levels were determined. IPSSs, quality of life (QoL) scores, maximal flow rates (Qmax) measured using uroflowmetry, and PSA values were recorded upon initial admission and during the follow-up period. The resected prostate tissue weight was calculated by a pathologist.

Based on patient cardiovascular conditions, the procedures were performed under spinal or general anesthesia in the lithotomy position. M-TURP procedures were performed using a 26-Fr resectoscope and a standard loop electrode (Valleylab Force system, Colorado, USA). The plasmakinetic method was performed using a 27-Fr continuous resectoscope and a Plasmasect Electrode (Gyrus Medical, UK). During surgeries, the bladder was irrigated using a glycine (5%) solution for M-TURP procedures and a saline solution for P-TURP procedures.

Intravenous ciprofloxacin was administered to patients as a postoperative antibiotic. Bladder irrigation using saline solution continued until the urine cleared. The urethral catheters were extracted at 12-24 hours after cessation of irrigation, and the patients were discharged after they urinated without any problems.

The patients administered with alpha blockers due to the growth of postoperative adenoma and those operated on due to urethral stricture, bladder-neck contracture or a growing adenoma were recorded. Urethral stricture or bladder-neck contracture was treated using cold-knife urethrotomy. Re-operations due to a growing adenoma were performed using monopolar TURP.

### Statistical analyses

The Statistical Package for the Social Sciences (SPSS) Windows Version 11.5 software package was used to compare data. The Mann-Whitney U test and Chi-squared test were used to determine the difference between two groups of continuous variables and categorical variables, respectively. P values <0.05 were accepted as significant.

## Results

Histology confirmed BPH in all patients who underwent M-TURP and P-TURP procedures. Of the 124 patients, 65 (52%) underwent M-TURP and 59 (48%) underwent P-TURP.

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All patients were followed-up over a period of 7 years. The average age of the patients in the M-TURP group was 63.87±3.87 years and in the P-TURP group was 64.28±3.97 years. There was no statistically significant difference between the M-TURP and P-TURP groups in any pre-operative or post-operative follow-up parameter at 1, 4 or 7 years after surgery (PSA, IPSS, QoL score, Qmax; Table 1). The resected prostate tissue weights were 28.9 g in the M-TURP group and 29.0 g in the P-TURP group (p=0.99).

At the 1-year postoperative follow-up, none of the patients in either group had undergone urethrotomy or re-operation or had initiated alpha blocker therapy.

At the 4-year postoperative follow-up, 2 (3.07%) patients in the M-TURP group and 3 (5.08%) patients in the P-TURP group had undergone cold-knife urethrotomy due to urethral stricture or bladder-neck contracture. Alpha-blocker therapy had been initiated in 7 patients (10.70%) in the M-TURP group and in 6 patients (10.10%) in the P-TURP group. Three patients (4.61%) in the M-TURP group and 2 patients (3.38%) in the P-TURP group had undergone re-operations. At the 4-year postoperative follow-up, there was no statistically significant difference between groups in the number of urethrotomies performed, the use of alpha-blockers or the frequency of re-operations (p>0.05).

At the 7-year postoperative follow-up, 3 (4.61%) patients in the M-TURP group and 5 (8.47%) patients in the P-TURP group underwent cold-knife urethrotomy due to urethral stricture or bladder-neck contracture. Alpha-blocker therapy was administered to 11 patients (16.92%) in the M-TURP group and 9 patients (15.25%) in the P-TURP group. Re-operations were performed on 6 patients (9.23%) in the M-TURP group and 5 patients (8.47%) in the P-TURP group. At the 7-year postoperative follow-up, there was no statistically significant difference between groups in the urethrotomies performed, the use of alpha-blockers or the frequency of re-operations (p>0.05). Follow-up data are shown in Tables 2, 3 and Figures 1-3.

## Discussion

Our study demonstrates that when the medium- to long-term results are compared, P-TURP and M-TURP appear to result in similar IPSS scores and Qmax values. The middle- to long-term complication rates and retreatment rates were also similar. The plasmakinetic method takes advantage of bipolar energy for the resection of prostate tissues.[3] The resection technique is similar between these procedures; however, P-TURP induces less bleed-

**Table 1. Pre-operative patient characteristics**

| | Monopolar group | Plasmakinetic group | p |
|---|---|---|---|
| Number of patients | 65 (52.41%) | 59 (47.58%) | |
| Age (years) | 63.87±3.87 | 64.28±3.97 | 0.39 |
| PSA (ng/mL) | 4.09±1.54 | 4.55±1.27 | 0.11 |
| IPSS | 23.53±1.46 | 24.13±1.16 | 0.57 |
| QoL score | 4.18±0.96 | 4.23±0.81 | 0.58 |
| Qmax (mL/sec) | 9.36±1.00 | 9.61±0.96 | 0.15 |

PSA: Prostate specific antigen; IPSS: International Prostate Symptom Score; QoL: Quality of life; Qmax: Maximal flow rate

**Table 2. Follow-up data**

| | Preoperative | 1st year | 4th year | 7th year |
|---|---|---|---|---|
| PSA (ng/mL) | | | | |
| M-TUR | 4.09±1.54 | 1.46±0.28 | 2.03±0.21 | 2.81±0.99 |
| P-TUR | 4.55±1.27 | 1.41±0.31 | 1.94±0.22 | 2.96±0.90 |
| p value | 0.11 | 0.25 | 0.48 | 0.45 |
| IPSS | | | | |
| M-TUR | 23.53±1.46 | 4.80±0.77 | 6.61±0.78 | 9.16±0.87 |
| P-TUR | 24.13±1.16 | 4.96±0.87 | 6.81±0.79 | 9.44±0.81 |
| p value | 0.57 | 0.36 | 0.22 | 0.57 |
| Qmax (mL/sec) | | | | |
| M-TUR | 9.36±1.00 | 18.81±0.88 | 17.24±0.91 | 16.26±1.27 |
| P-TUR | 9.61±0.96 | 18.94±0.97 | 17.15±0.78 | 16.47±1.25 |
| p value | 0.15 | 0.71 | 0.18 | 0.33 |

PSA: Prostate Specific Antigen; M-TURP: Monopolar-Transurethral resection of the prostate; P-TURP: Plasmakinetic-Transurethral resection of the prostate; IPSS: International Prostate Symptom Score; Qmax: Maximal flow rate

**Table 3. Follow-up data**

| | 1st year | 4th year | 7th year |
|---|---|---|---|
| Urethrotomy (n) | | | |
| M-TUR | _ | 2 (3.07%) | 3 (4.61%) |
| P-TUR | _ | 3 (5.08%) | 5 (8.47%) |
| p value | _ | 0.57 | 0.38 |
| Alpha-blocker therapy (n) | | | |
| M-TUR | _ | 7 (10.7%) | 11 (16.92%) |
| P-TUR | _ | 6 (10.1%) | 9 (15.25%) |
| p value | _ | 0.91 | 0.80 |
| Re-operation (n) | | | |
| M-TUR | _ | 3 (4.61%) | 6 (9.23%) |
| P-TUR | _ | 2 (3.38%) | 5 (8.47%) |
| p value | _ | 0.73 | 0.95 |

M-TURP: Monopolar-Transurethral resection of the prostate;
P-TURP: Plasmakinetic-Transurethral resection of the prostate

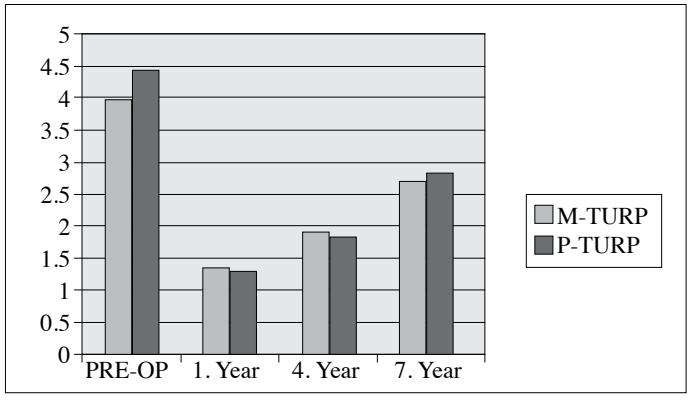


Figure 1. Mean PSA value (ng/mL)

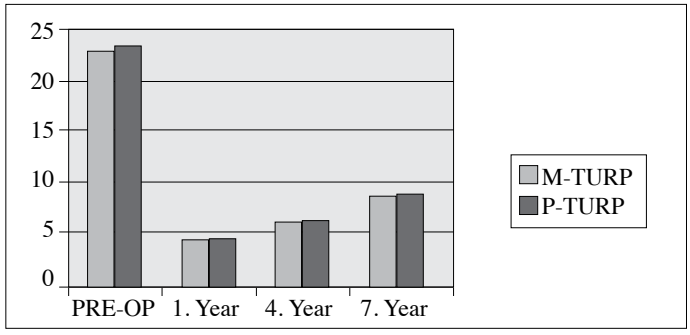


Figure 2. Mean IPSS value

ing and enhances the surgical field of view, although it involves similar resection times and coagulation.[4] Various studies with limited follow-up periods have been performed to demonstrate the efficacy and safety of P-TURP. Seckiner et al.[6] reported

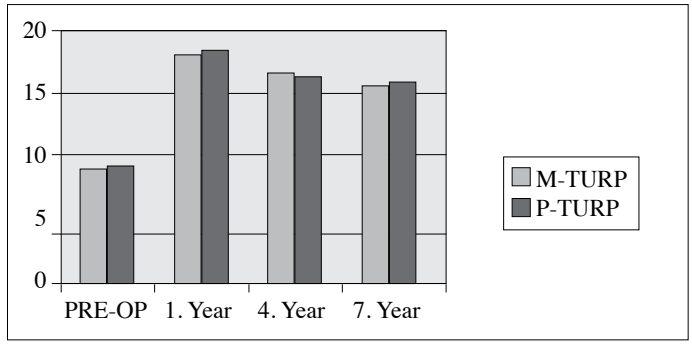


Figure 3. Mean Qmax value (mL/sn)

that due to the decreased risk of TUR syndrome after 1-year of follow-up, an enlarged prostate could be treated using P-TURP without time limitations. However, they reported no advantages of P-TURP in terms of intra-and post-operative bleeding, the duration of hospitalization, operation time and late complications. Patankar et al.[8] emphasized that P-TURP enabled faster tissue resection in a bloodless area and a safer surgery using saline irrigation. Bhansali et al.[9] stated that P-TURP could be used safely and effectively for the resection of a large gland (>60 g) based on a minimum of 9 months follow-up data. Yoon et al.[10] determined a shorter catheterization (2.28 vs. 3.12 days) and hospitalization time (3.52 vs. 4.27 days) in P-TURP in 102 patients.

In 2007, Erturhan et al.[7] reported that the first year of follow-up showed that P-TUR appeared to be a promising treatment alternative to M-TURP that required shorter catheterization and convalescence times and hospital stays. The lower levels of intra-operative and post-operative complications, lower instances of bleeding that necessitated transfusions, perfect intra-operative hemostasis and the absence of fluid absorption or TUR syndrome were reported as major advantages of P-TURP. Our article presents data on a long-term follow-up period to provide mid-to-long term results on efficacy.

In a study comparing long-term outcomes between M-TURP and P-TURP, Autorino et al.[11] observed a 3-fold improvement in IPSS and Qmax after four years of follow-up. After a follow-up of 100 months, Muslumanoglu et al.[12] emphasized the reliability of the P-TURP compared with monopolar TURP. In another study, Zhao et al.[13] reported that after 3 years of follow-up, the clinical efficacy of P-TURP was durable and compared favorably with M-TURP. In our study, there was no statistically significant difference between the M-TURP and the P-TURP groups in IPSS or Qmax values at the 4- and 7-year follow-up. In this middle- to long-term follow-up study of both surgery methods, similar IPSS and Qmax scores were obtained. These findings suggest that regardless of the surgery methods, each TURP procedure involves similar micturition parameters. After each surgical procedure, urethral stricture can develop

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due to the diameter of the resectoscope and the long duration of the procedure.[10,14] Additionally, the higher ablative energy used during the P-TURP is another factor.[15] After extensive studies, it has been reported that urethral stricture may occur at a rate of 2.2-9.8% following M-TURP surgery.[16] Autorino et al.[11] observed that after 4 years, urethral stricture occurred at a rate of 6.2% after M-TURP and 3% after P-TURP. Zhao et al.[13] reported that after 3 years urethral stricture occurred at a rate of 2.9% after M-TURP, whereas no stricture was encountered in their series treated with P-TURP. Muslumanoglu et al.[12] reported similar rates of strictures after a follow-up of 100 months. In our study, after the first 4 years of follow up, urethral stricture occurred in 3.07% of patients after M-TURP and in 5.08% of patients after P-TURP, and at the end of the 7th year of follow-up, urethral stricture occurred in 4.61% and 8.47% patients, respectively ($p>0.05$). Although there was no statistically significant difference between the two groups in rates of urethral stricture, P-TURP patients showed an approximately 2-fold increase in rate compared with M-TURP patients. This increase was attributed to the use of the 27-Fr resectoscope during the P-TURP procedure.

Due to the growing adenoma after TURP, alpha blocker therapy may be required in the medium- to long-term, and the TURP procedure may be repeated as necessary. Alpha blocker therapy was required in 21.2% and 23.5% of M-TURP and P-TURP patients, respectively, after a 100-month follow-up.[12] In our study, the rates were 10.7% and 10.1% at 4 years and 15.25% and 16.92% at 7 years, respectively.

Retreatment rates range from 3-14.5% after TURP over a 5-year follow-up period.[16] Following M-TURP and P-TURP, re-operation rates were reported as 9.6% and 6.2% after 4 years of follow-up and 9% and 11.8% at the end of 100 months, respectively.[11,12] In our study, re-operation rates were calculated as 4.61% and 3.38% in the 4th year and 9.23% and 8.47% in the 7th year ($p<0.05$). These similar and acceptable re-operation rates showed additional advantages of each TURP surgery.

The limitations of our study are the limited sample size and the single center used. Furthermore, we did not include transrectal ultrasonographic prostate volumes at follow-up or sexual functions. However, in their 3-year follow-up report, Zhao et al.[13] showed changes in ultrasonographic prostate volume and sexual function.

In conclusion, we compared results at 4 and 7 years post-surgery (medium-to-long-term) and showed that P-TURP and M-TURP appeared to result in similar IPSS scores, Qmax values, complication rates and retreatment rates. We recommend that surgeons choose the TURP method based on their surgical experience. However, larger prospective studies are required to corroborate our results.

**Conflict of Interest**
No conflict of interest was declared by the authors.

**Peer-review:** Externally peer-reviewed.

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Author Contributions**
Concept - ÖB., İS.; Design - SE.,ÖB.; Supervision -SE.; Funding - SE., İS.; Materials - ÖB.; Data Collection and/or Processing - ÖB., AD.; Analysis and/or Interpretation - ÖB., AD.; Literature Review - ÖB., SE.; Writer - ÖB.; Critical Review - AE., FY.

**Çıkar Çatışması**
Yazarlar herhangi bir çıkar çatışması bildirmemişlerdir.

**Hakem değerlendirmesi:** Dış bağımsız.

**Hasta Onamı:** Yazılı hasta onamı bu çalışmaya katılan hastalardan alınmıştır.

**Yazar Katkıları**
Fikir - ÖB., İS.; Tasarım - SE.,ÖB.; Denetleme - SE.; Kaynaklar - SE., İS.; Malzemeler - ÖB.; Veri toplanması ve/veya işlemesi - ÖB., AD.; Analiz ve/veya yorum - ÖB., AD.; Literatür taraması - ÖB., SE.; Yazıyı yazan - ÖB.; İnceleme - AE., FY.

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