Reprinted from JOURNAL OF UROLOGY
Published Ahead of Print, Post-Author Corrections April 19, 2021

Published by Lippincott Williams & Wilkins Printed in U.S.A.

Author's Accepted Manuscript

Final 5-Year Outcomes of the Multicenter Randomized Sham-Controlled Trial of Rezūm Water Vapor Thermal Therapy for Treatment of Moderate-to-Severe Lower Urinary Tract Symptoms Secondary to Benign Prostatic Hyperplasia

McVary KT, Gittelman MC, Goldberg KA, Patel K, Shore ND, Levin RM, Pliskin M, Beahrs JR, Prall D, Kaminetsky J, Cowan BE, Cantrill CH, Mynderse LA, Ulchaker JC, Tadros NN, Gange SN, and Roehrborn CG

DOI: 10.1097/JU.0000000000001778
Reference: JU-21-126

To appear in: *The Journal of Urology*
Accepted Date: 18 March 2021

Please cite this article as: McVary KT, Gittelman MC, Goldberg KA, Patel K, Shore ND, Levin RM, Pliskin M, Beahrs JR, Prall D, Kaminetsky J, Cowan BE, Cantrill CH, Mynderse LA, Ulchaker JC, Tadros NN, Gange SN, and Roehrborn CG, Final 5-Year Outcomes of the Multicenter Randomized Sham-Controlled Trial of Rezūm Water Vapor Thermal Therapy for Treatment of Moderate-to-Severe Lower Urinary Tract Symptoms Secondary to Benign Prostatic Hyperplasia, *The Journal of Urology®* (2021), doi: 10.1097/JU.0000000000001778.

Final 5-Year Outcomes of the Multicenter Randomized Sham-Controlled Trial of Rezūm Water Vapor Thermal Therapy for Treatment of Moderate-to-Severe Lower Urinary Tract Symptoms Secondary to Benign Prostatic Hyperplasia

Kevin T. McVary, Marc C. Gittelman, Kenneth A. Goldberg, Kalpesh Patel, Neal D. Shore, Richard M. Levin, Marc Pliskin, J. Randolf Beahrs, David Prall, Jed Kaminetsky, Barrett E. Cowan, Christopher H. Cantrill, Lance A. Mynderse, James C. Ulchaker, Nicholas N. Tadros, Steven N. Gange, and Claus G. Roehrborn

Loyola University Medical Center, Maywood, Illinois, USA (KTM)

South Florida Medical Research, Aventura, Florida (MCG)

University of Texas Southwestern, Lewisville, Texas (KAG)

Arizona Institute of Urology, Tucson, Arizona (KP)

Carolina Urologic Research Center, Myrtle Beach, South Carolina (NDS)

Chesapeake Urology Research Associates, Towson, Maryland (RML)

The Urology Group, Cincinnati, Ohio (MP)

Minnesota Urology, Woodbury, Minnesota (JRB, DP)

Manhattan Medical Research, New York, New York (JK)

Urology Associates of Denver, Englewood, Colorado (BEC)

Urology San Antonio Research, San Antonio, Texas (CHC)

Mayo Clinic, Rochester, Minnesota (LAM)

Cleveland Clinic, Cleveland, Ohio (JCU)

Southern Illinois University, Springfield, Illinois (NNT)

Western Urologic Clinic, Salt Lake City, Utah (SNG)

University of Texas Southwestern, Dallas, Texas (CGR)

Brief title: Minimally invasive prostate convective water vapor thermal energy ablation

Key words: prostate, benign prostatic hyperplasia, minimally invasive, water vapor thermal therapy

Corresponding Author:

Kevin T. McVary, MD, FACS

Director, Center for Male Health

Professor of Urology

Stritch School of Medicine

Loyola University Medical Center

2160 South First Avenue

Maywood, IL 60153

Email: kmcvary@gmail.com

Phone: 708-216-3166; Fax 708-216-6585

OBJECTIVE: To present final 5-year outcomes of the multicenter randomized sham-controlled trial of Rezum water vapor therapy for treatment of moderate-to-severe LUTS due to BPH.

MATERIALS AND METHODS: Total of 197 subjects ≥ 50 years of age, with IPSS ≥ 13, maximum flow rate (Qmax) ≤15 mL/s and prostate volume 30 to 80 cc were randomized and followed for 5 years. From the 61 subject control arm, a subset of 53 subjects requalified and after 3 months, received treatment as part of the crossover group and were also followed for 5 years. The total number of vapor treatments to each lobe of the prostate was determined by length of prostatic urethra and included middle lobe treatment per physician discretion.

RESULTS: Significant improvement of LUTS was observed at ≤ 3 months post thermal therapy, remaining durable through 5 years in the treatment group (IPSS reduced 48%, QOL increased 45%, Qmax improved 44%, BPHII decreased 48%). Surgical retreatment rate was 4.4% with no reports of device or procedure related sexual dysfunction or sustained de novo erectile dysfunction. Results within the crossover group were similar through 5 years.

CONCLUSION: Minimally invasive treatment with Rezum water vapor thermal therapy provides significant and durable symptom relief as well as flow rate improvements through 5 years, with low surgical retreatment rates and without impacting sexual function. It is a versatile therapy, providing successful treatment to obstructive lateral and middle lobes.

Introduction

The prevalence of BPH rises drastically as age advances. Between 50% and 70% of men suffer from LUTS associated with BPH after the age of 50 years while evidence suggests that the prevalence of LUTS/BPH is as high as 80% by the 8th decade.[1]

The available treatment options for moderate-to-severe LUTS/BPH range from oral medications to surgical treatments.[2] Most commonly, the first line of treatment is medication, via AB and/or 5-ARI prescribed as either mono- or combination therapy. Evidence suggests however that due to AEs, poor medication adherence, and/or disease progression many men seek secondary treatment.[3] Common AEs associated with AB include abnormal ejaculation due to reduced or absent seminal fliuid, dizziness and postural hypotension; with 5-ARIs, AEs include erectile dysfunction, reduced libido and less commonly ejaculation failure, retrograde ejaculation and gynaecomastia.[4] TURP has traditionally been considered the gold-standard surgical treatment option.[2] While TURP has demonstrated its efficacy in improving urinary symptoms, acute safety concerns and long-term negative impacts such as erectile and ejaculatory disfunction, possible incontinence, as well as other associated complications have been well documented.[5]

As an alternative to TURP, MISTs have emerged as options to relieve symptoms while minimizing or eliminating hospital stays and complications.[2] Rezum water vapor thermal therapy (Rezum System, Boston Scientific, Marlborough, MA) is an innovative MIST cleared by the FDA in 2015 to reduce prostate tissue volume associated with BPH including hyperplasia of the central zone and/or a middle lobe.[6] This therapy transfers stored thermal energy (540 calories/mL H_2O) as vapor to the prostatic tissue. No thermal effects occur outside the targeted treatment zone,[7] thus addressing limitations of conductive heat transfer experienced with other MISTs, such as TUNA and TUMT where cell kill gradient was noted.[8]

The most unique feature of Rezum thermal therapy is that it can treat lateral and central zones without morphological limitation or learning an advanced technique. Difficult anatomic varients, such as intravesical prostatic protrusion, can be treated without effects on sexual function.[9] In the 5 years following FDA clearance, the Rezum system has been embraced by urology practices, health technology assessment bodies, and urologic societies throughout the US and Europe.[10, 11] This adoption is attributed to the evidence of its clinical advantages, including sustained relief of LUTS, enhanced quality of life, and durability of treatment response.[12-14] In this manuscript, we report final 5 year clinical results for the treatment- and crossover-arms for the multicenter, prospective, blinded, controlled trial of Rezum water vapor thermal therapy (Rezum II Study, NCT01912339).

Materials & Methods

The Rezum II pivotal study was conducted at 15 centers in the United States with a follow-up period of 5 years. In total, 384 subjects were screened and 197 subjects entered the study. All participants signed a written informed consent form prior to participation, and approval of the protocol was granted by an institutional review board for each participating investigational site. Subjects, ≥ 50 years of age, who had moderate-to-severe symptomatic BPH, were included in the study. A complete list of inclusion and exclusion criteria for this clinical trial have been previously published.[15] Key inclusion criteria included an IPSS ≥13 and prostate volume of 30 cm^3 to 80 cm^3 without restrictions on the presence of a middle

lobe. Subjects were randomized to treatment and control in a 2:1 ratio using a permuted-block randomization schedule with varying block size, stratified on center and baseline IPSS. Unblinded at the 3-month follow-up visit, 53 control subjects requalified for inclusion in the study and elected to receive Rezum thermal therapy. Crossover treatment occurred within 3 to 6 months post-enrollment date.

Statistical Method

The study was powered at 80% with 0.025 one-sided type I error to evaluate the hypothesis that the reduction in IPSS from baseline to 3 months for the active treatment exceeds 125% of that for the control. This hypothesis was assessed using a Student t-test on the ITT populations to compare the mean changes in treatment and control arms. For the primary efficacy endpoint, subjects who chose alternate treatments other than the assigned treatment prior to the 3-month follow up period were considered failures and their baseline value was used for the primary endpoint analysis. Summary results for quantitative variables were presented as mean ± standard deviation.

Procedure

The technology, device description and technical details of the procedure for Rezum water vapor thermal therapy have been published in detail in earlier reports.[12] The basic principle of the Rezum System is to apply a controlled level of RF power to an inductive coil heater in the Delivery Device through which a pre-determined amount of sterile water is delivered to selected areas of the prostate. Using a transurethral approach, the heat generated by the RF power transforms the sterile water from liquid to vapor state (stored thermal energy). The vapor is convectively delivered directly into the tissue interstices of the hyperplastic tissue in the transition zone of the prostate when treating the lateral lobes, or in the central zone of the prostate in the case of treatment for an obstructive middle lobe. Each vapor injection lasts for 9 seconds. The number of injections varies from case to case depending on the size of the prostate and whether the physician chooses to treat the median tissue. Subjects in the control arm underwent a sham procedure with 19F to 21F rigid cystoscopy.

Study Assessment

The efficacy endpoint comparing the treatment and sham/control arms was measured at 3 months post-procedure via IPSS. Subjects were unblinded following completion of their 3-month follow-up visit and participants in the control arm were offered the option of treatment with the Rezum System if they still met the initial study inclusion criteria. Crossover treatment occurred within 3 to 6 months post-enrollment date. Subjects in the treatment and crossover-arms were followed at 3, 6, and 12 months and then annually until 5 years. At each follow-up visit, subjects were evaluated by measuring Qmax, PVR volume, voided volume, and PSA, and by administration of the IPSS, IPSS-QOL and BPHII, surveys. Incontinence was assessed using the OAB-q SF and ICS male IS-SF; sexual function was assessed using IIEF-EF and MSHQ-EjD. The protocol pre-specified a responder endpoint defined as freedom from retreatment for BPH and 30% reduction of IPSS from baseline. AEs were captured and adjudicated by independent data monitoring and clinical events committees. To prevent lost to follow up and minimize attrition, patients were closely followed as per clinical trial protocol. Retreatment of BPH, by medical or surgical management, was recorded and follow-up of the subject discontinued.

Results

One hundred thirty six subjects were randomized to the Rezum treatment-arm and 61 subjects were randomized to the control-arm. Fifty three control subjects requalified for crossover, received treatment and participated in follow-up through 5 years.(Table-1)

All of the Rezum treatments were completed in the office or ambulatory-surgery center. Of these 188 treated subjects, 170 (90.4%) received oral pain medication, 39 (20.7%) received a prostate block/epidural and 19 (10.1%) subjects received IV sedation (one subject opted out of the study after preparation for the procedure, but prior to treatment). The mean number of vapor injections per subject was 4.5 ± 1.8 (135) and 5.1 ± 1.9 (53) across the treatment and crossover groups respectively. Middle lobe was noted and treated in 58 of 188 subjects (30.9%). These subjects received an additional mean 1.6 injections ± 0.7 to the median tissue. The average procedure time (initial insertion of device until complete removal) for subjects in the treatment-arm was 5.3 minutes ± 3.5 and 4.4 minutes ± 1.7 in the crossover-arm.

As noted in Figure-1, after 5 years, data from 77 subjects from the treatment-arm were analyzed. There were no study withdrawals attributed to any procedure or device-related AEs. Eighteen subjects were lost to follow-up while an additional 13 withdrew consent. Five subjects were censored for protocol non-compliance, and 2 were withdrawn for prostate cancer treatment. Within the crossover group, 21 subjects completed 5 years of follow-up. Ten subjects withdrew consent and an additional 5 were lost to follow-up. One subject was censored for non-compliance, 1 due to cancer diagnosis, and 1 subject died due to unrelated causes.

Device and procedure related AEs were similar between groups. A total of 151 related-AEs were reported in 53 subjects in the treatment-arm and 59 events in 23 subjects in the crossover group. As expected, the most common AEs related to the device or procedure were dysuria (16.9% and 18.9%), gross hematuria (12.5% and 11.3%), hematospermia (7.4% and 3.8%), urinary frequency (5.9% and 5.7%), AUR (4.4% and 5.7%), suspected UTI (3.7% and 7.5%) and decrease in ejaculatory volume (3.7% and 7.5%) between the treatment and crossover-arms respectively. These AEs were mild to moderate in severity and resolved either spontaneously or with routine treatment. No late related-AEs occurred from years 1 to 5. Details of all other AEs, including the SAEs were previously reported.[12-14]

Outcome measures for the original treatment-arm are as follows: IPSS decreased from 22.0 points at baseline to 10.6 at three months for a change of −11.3 ± 7.6. The primary endpoint analysis demonstrated that the IPSS reduction in the active treatment exceeded 125% of that in the control arm ($P < 0.0001$). IPSS score improvement remained consistent throughout the study as the mean value at 5 years showed near 48% reduction (11.1 ± 7.8) from baseline. Similarly, the improved IPSS QOL score remained consistent from baseline reducing from a mean value of 4.4 ± 1.1 to 2.3 ± 1.5 at 3 months and to 2.2 ± 1.4 or 45% reduction at 5 years. Flowrate as measured by Qmax [voided volume ≥ 125 mL] exhibited similar sustained improvement: increasing from a baseline of 9.9 ± 2.2 to 15.5 ± 6.7 at the end of year 1 and remained at 14 ± 5.4 (49%) through year 5 of follow-up. Additionally, 5-year BPHII results, which peaked at a 65% decrease 6 months post-treatment (2.2 ± 2.6), showed similarly durable improvement with a mean decline of 48% at 5 years (2.8 ± 3.2).(Figure-2) Further, 61% of subjects in the treatment-arm (82 of 135) were both free from retreatment and had a 30% or greater reduction from baseline IPSS at 5 years.

There were no reports of de novo device or procedure-related erectile dysfunction throughout the duration of the study. Five-year results corresponded well with prior time points. Mean PSA value remained stable through 5 years of follow-up. Modest changes were observed in IIEF-EF, MSHQ-Function at 5 years consistent with the aging of the treated cohort, with changes of -2.4 ± 9.2 and -2.0 ±3.9 respectively.[16] MSHQ-EjD Bother score improvement remained consistent through the length of follow-up with a 16% improvement at 60 months (Appendix).

As displayed in Figure-3, the total surgical retreatment rate for the treatment-arm at the end of the study was 4.4%. Within that group, 83% of the surgical retreatments occurred in the first 2 years of follow-up, with no treatment-arm subjects receiving surgical retreatment after year 3. As was noted in a prior manuscript, of the 6 subjects retreated surgically, 4 of these subjects had identified obstructive median tissue that was initially left untreated.[12] An additional 11.1% of treatment-arm subjects were retreated with BPH medication through 5 years. Four crossover-arm subjects were retreated surgically (3 for previously untreated obstructive median tissue) and 10 received BPH medication.

Discussion

The results of this RCT revealed that Rezum thermal therapy for BPH has clinically meaningful outcomes and proven durability. The inclusion of patients with obstructive median tissue underscores the rare versatility of water vapor thermal therapy especially among MISTs, as Rezum is capable of ablating tissue from lateral lobes as well as tissue of an enlarged central zone (i.e. middle lobe or median bar) without advanced training or learning a complex technique.[17]

The 5-year responder analysis endpoint (30% improvement of IPSS and freedom from retreatment) is also of particular importance given the recent draft guidance proposed by FDA as the basis for minimal clinical improvement following device therapy for BPH as reported in the analysis from Roehrborn et al.[18, 19] Without a predefined measure for clinically significant difference, this IPSS responder analysis provides a reliable surrogate.

Other MISTs like PUL or other implantable devices, provide relief from symptoms without removing tissue. It is perhaps less surprising then that the 5-year surgical retreatment rate of 4.4% for the treatment-arm herein compares so favorably to the 13.6% reported in the 5-year LIFT study.[20] These results also compare well to other MISTs as TUNA and TUMT where 5-year study surgical retreatment rates ranged from 14% to 51% and 8.9% to 21% respectively.[21-23] This is noteworthy when considering that 7 of the 10 subjects retreated surgically in this study had identified middle lobes that were previously untreated, supporting a more durable impact on LUTS if an obstructive middle lobe is addressed when noted.

Despite the majority of subjects in this study presenting with severe LUTS at enrollment (72.5% with IPSS 19-35) outcomes measured by storage and voiding function, urinary flow rates, quality of life improved from the first visit 3 months post-procedure through the final at 60 months after a single water vapor thermal therapy treatment without negatively impacting sexual function. In order to produce outcome measures with similar results to this study, pharmacotherapy requires patients to adhere to a combination of interminable prescription regimens, which often have undesirable sexual side effects.[9, 24, 25] To achieve similar results with PUL, permanent implants are required, but the retreatment rates appear much higher.[26] The Rezum II study results aid in establishing water vapor

therapy as a first-line treatment for BPH. Patients who may be candidates for Rezum are often referred to more invasive surgical techniques such as TURP, HoLEP, or other laser treatments that can involve greater bleeding risks, longer-term recovery time, declines in measures of sexual function, and other undesirable side effects.[27]

Study limitations included participant attrition, but that is neither unique to this trial, nor studies within this disease state. As was the case with the LIFT study, a similar percentage of participants from the treatment-arm were evaluated at 5 years per protocol (62%) as this study (57%), and in each study the statistical significance of the functional results was not negatively impacted.[20] Attrition rates are also similar for prospective studies with other modalities like TURP,[23, 28] PVP,[29] TUMT,[30] and TUNA.[23] Additionally, the lack of urodynamic testing limits the opportunity to analyze bladder function, the degree of obstruction, and bladder contractility and the potential impact on these reported results.

Conclusion

Water vapor thermal therapy for BPH is a treatment that combines the properties of a MIST with the functional outcomes expected from other ablative therapies. There is a short learning curve without the need for advanced techniques to treat various zones of the prostate, including an obstructive middle lobe. The positive safety profile, long term durability, and maintenance of sexual function make water vapor thermal therapy an optimal treatment choice for patients with moderate-to-severe LUTS.

Acknowledgements

We would like to acknowledge the contributions of Kyle DeRouen, Sirikan Rojanasarot, PhD, Amit Mondal, MS, Kevin Hagelin, and the Boston Scientific Clinical Operations and Biostatistics Teams.

References:

1. Egan, K. B.: The Epidemiology of Benign Prostatic Hyperplasia Associated with Lower Urinary Tract Symptoms: Prevalence and Incident Rates. Urol Clin North Am, **43:** 289, 2016
2. Foster, H. E., Dahm, P., Kohler, T. S. et al.: Surgical Management of Lower Urinary Tract Symptoms Attributed to Benign Prostatic Hyperplasia: AUA Guideline Amendment 2019. J Urol, **202:** 592, 2019
3. Gul, Z. G., Kaplan, S. A.: BPH: Why Do Patients Fail Medical Therapy? Curr Urol Rep, **20:** 40, 2019
4. Gravas, S., Cornu, J. N., Gacci, M. et al.: EAU Guidelines on Management of Non-neurogenic Male LUTS, Presented at the EAU Annual Congress Amsterdam ed. Arnhem, The Netherlands. http://uroweb.org/guidelines/compilations-of-all-guidelines/: EAU Guidelines Office, 2020
5. Friedl, A., Schneeweiss, J., Stangl, K. et al.: The Adjustable Transobturator Male System in Stress Urinary Incontinence After Transurethral Resection of the Prostate. Urology, **109:** 184, 2017
6. SCIENTIFIC, B.: Intended USE. In: rezum Instruction for Use, p. 5
7. Dixon, C. M., Rijo Cedano, E., Mynderse, L. A. et al.: Transurethral convective water vapor as a treatment for lower urinary tract symptomatology due to benign prostatic hyperplasia using the Rezum((R)) system: evaluation of acute ablative capabilities in the human prostate. Res Rep Urol, **7:** 13, 2015
8. Bouza, C., Lopez, T., Magro, A. et al.: Systematic review and meta-analysis of Transurethral Needle Ablation in symptomatic Benign Prostatic Hyperplasia. BMC Urol, **6:** 14, 2006
9. McVary, K. T., Rogers, T., Mahon, J. et al.: Is Sexual Function Better Preserved After Water Vapor Thermal Therapy or Medical Therapy for Lower Urinary Tract Symptoms due to Benign Prostatic Hyperplasia? J Sex Med, **15:** 1728, 2018
10. Excellence, N. I. f. H. a. C.: Rezum for treating lower urinary tract symptoms secondary to benign prostatic hyperplasia, 2020
11. Gravas, S., Cornu, J. N., Gacci, M. et al.: EAU Guidelines on the Assessment of Non-neurogenic Male Lower Urinary Tract Symptoms including Benign Prostatic Obstruction: EAU Guidelines Office, Arnhem, The Netherlands. http://uroweb.org/guidelines/compilations-of-all-guidelines/, 2020
12. McVary, K. T., Rogers, T., Roehrborn, C. G.: Rezum Water Vapor Thermal Therapy for Lower Urinary Tract Symptoms Associated With Benign Prostatic Hyperplasia: 4-Year Results From Randomized Controlled Study. Urology, **126:** 171, 2019
13. McVary, K. T., Roehrborn, C. G.: Three-Year Outcomes of the Prospective, Randomized Controlled Rezum System Study: Convective Radiofrequency Thermal Therapy for Treatment of Lower Urinary Tract Symptoms Due to Benign Prostatic Hyperplasia. Urology, **111:** 1, 2018
14. Roehrborn, C. G., Gange, S. N., Gittelman, M. C. et al.: Convective Thermal Therapy: Durable 2-Year Results of Randomized Controlled and Prospective Crossover Studies for Treatment of Lower Urinary Tract Symptoms Due to Benign Prostatic Hyperplasia. J Urol, **197:** 1507, 2017
15. McVary, K. T., Gange, S. N., Gittelman, M. C. et al.: Minimally Invasive Prostate Convective Water Vapor Energy Ablation: A Multicenter, Randomized, Controlled Study for the Treatment of Lower Urinary Tract Symptoms Secondary to Benign Prostatic Hyperplasia. J Urol, **195:** 1529, 2016
16. Fwu, C. W., Eggers, P. W., Kirkali, Z. et al.: Change in sexual function in men with lower urinary tract symptoms/benign prostatic hyperplasia associated with long-term treatment with doxazosin, finasteride and combined therapy. J Urol, **191:** 1828, 2014
17. Rukstalis, D., Grier, D., Stroup, S. P. et al.: Prostatic Urethral Lift (PUL) for obstructive median lobes: 12 month results of the MedLift Study. Prostate Cancer Prostatic Dis, **22:** 411, 2019

18. Health, C. f. D. a. R.: Select Updates for Guidance for the Non-Clinical and Clinical Investigation of Devices Used for the Treatment of Benign Prostatic Hyperplasia (BPH): Draft Guidance for Industry and Food and Drug Administration Staff, vol. FDA-2020-D-1118, 2020
19. Roehrborn, C. G., Wilson, T. H., Black, L. K.: Quantifying the contribution of symptom improvement to satisfaction of men with moderate to severe benign prostatic hyperplasia: 4-year data from the CombAT trial. J Urol, **187:** 1732, 2012
20. Roehrborn, C. G., Barkin, J., Gange, S. N. et al.: Five year results of the prospective randomized controlled prostatic urethral L.I.F.T. study. Can J Urol, **24:** 8802, 2017
21. Zlotta, A. R., Giannakopoulos, X., Maehlum, O. et al.: Long-term evaluation of transurethral needle ablation of the prostate (TUNA) for treatment of symptomatic benign prostatic hyperplasia: clinical outcome up to five years from three centers. Eur Urol, **44:** 89, 2003
22. Rosario, D. J., Phillips, J. T., Chapple, C. R.: Durability and cost-effectiveness of transurethral needle ablation of the prostate as an alternative to transurethral resection of the prostate when alpha-adrenergic antagonist therapy fails. J Urol, **177:** 1047, 2007
23. Hill, B., Belville, W., Bruskewitz, R. et al.: Transurethral needle ablation versus transurethral resection of the prostate for the treatment of symptomatic benign prostatic hyperplasia: 5-year results of a prospective, randomized, multicenter clinical trial. J Urol, **171:** 2336, 2004
24. Gupta, N., Rogers, T., Holland, B. et al.: Three-Year Treatment Outcomes of Water Vapor Thermal Therapy Compared to Doxazosin, Finasteride and Combination Drug Therapy in Men with Benign Prostatic Hyperplasia: Cohort Data from the MTOPS Trial. J Urol, **200:** 405, 2018
25. Gill, B. C., Ulchaker, J. C.: Costs of Managing Benign Prostatic Hyperplasia in the Office and Operating Room. Curr Urol Rep, **19:** 72, 2018
26. Miller, L. E., Chughtai, B., Dornbier, R. A. et al.: Surgical Reintervention Rate after Prostatic Urethral Lift: Systematic Review and Meta-Analysis Involving over 2,000 Patients. J Urol, **204:** 1019, 2020
27. Rassweiler, J., Teber, D., Kuntz, R. et al.: Complications of transurethral resection of the prostate (TURP)--incidence, management, and prevention. Eur Urol, **50:** 969, 2006
28. Liu, Z., Li, Y. W., Wu, W. R. et al.: Long-term Clinical Efficacy and Safety Profile of Transurethral Resection of Prostate Versus Plasmakinetic Resection of the Prostate for Benign Prostatic Hyperplasia. Urology, **103:** 198, 2017
29. Malde, S., Rajagopalan, A., Patel, N. et al.: Potassium-titanyl-phosphate laser photoselective vaporization for benign prostatic hyperplasia: 5-year follow-up from a district general hospital. J Endourol, **26:** 878, 2012
30. Mynderse, L. A., Roehrborn, C. G., Partin, A. W. et al.: Results of a 5-year multicenter trial of a new generation cooled high energy transurethral microwave thermal therapy catheter for benign prostatic hyperplasia. J Urol, **185:** 1804, 2011

Table 1.

Table 1. Baseline Characteristics of Treatment and Crossover Subjects		
Characteristic	**Treatment (n=135*)**	**Crossover (n=53)**
	Mean +/- SD	**Mean +/- SD**
Age at screening, years	63.0 ± 7.1	62.9 ± 7.0
PSA, ng/mL	2.1 ± 1.5	2.1 ± 1.6
IPSS	22.0 ± 4.8	20.0 ± 6.6
IPSS QoL	4.4 ± 1.1	3.9 ± 1.4
Prostate Volume, cm^3	45.9 ± 12.9	44.5 ± 13.3
Q_{max}, mL	9.9 ± 2.2	10.1 ± 3.7
PVR, mL	82.4 ± 51.5	93.9 ± 77.2

PSA: Prostate Specific Antigen, IPSS: International Prostate Symptom Score, QoL: Quality of Life, Q_{max}: Peak Flow Rate, PVR: Post Void Residual

*One subject from the treatment cohort opted out immediately from the study without being treated with the Rezum procedure, and consequently, that subject was not considered while calculating the average baseline values.

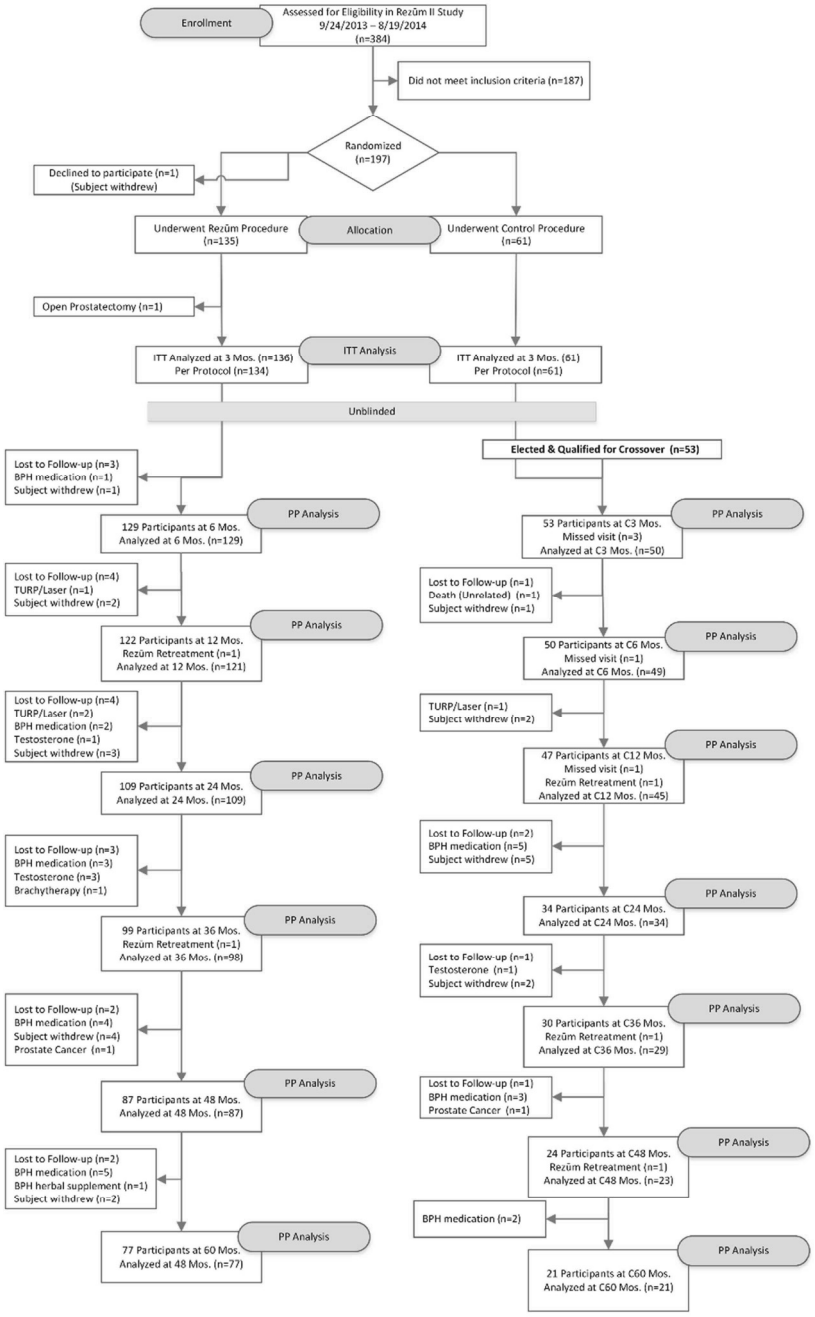


Figure-1. *CONSORT (Consolidated Standards of Reporting Trials) diagram of subject disposition in Rezum water vapor thermal therapy study including the thermal therapy, control and crossover (C) groups. *Subjects retreated with Rezum procedures were excluded from analysis. ITT, intent to treat analysis; PP, per protocol analysis; TURP, transurethral resection of prostate. (Color version available online.)*

Figure-2.

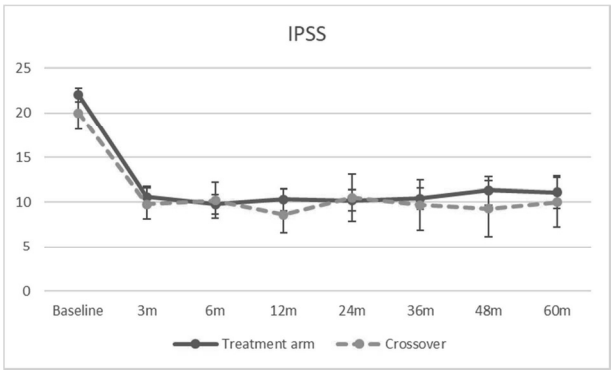


Figure 1(A) IPSS

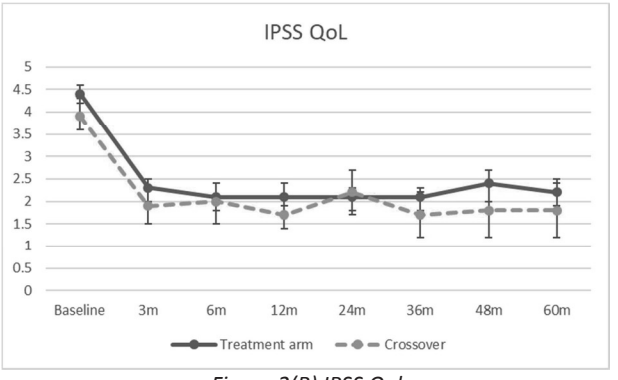


Figure 2(B) IPSS Qol

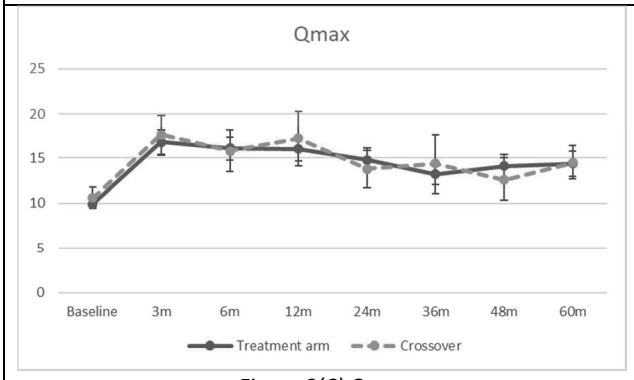


Figure 2(C) Qmax

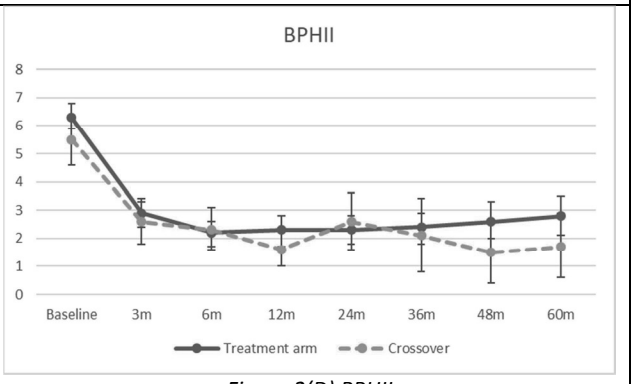
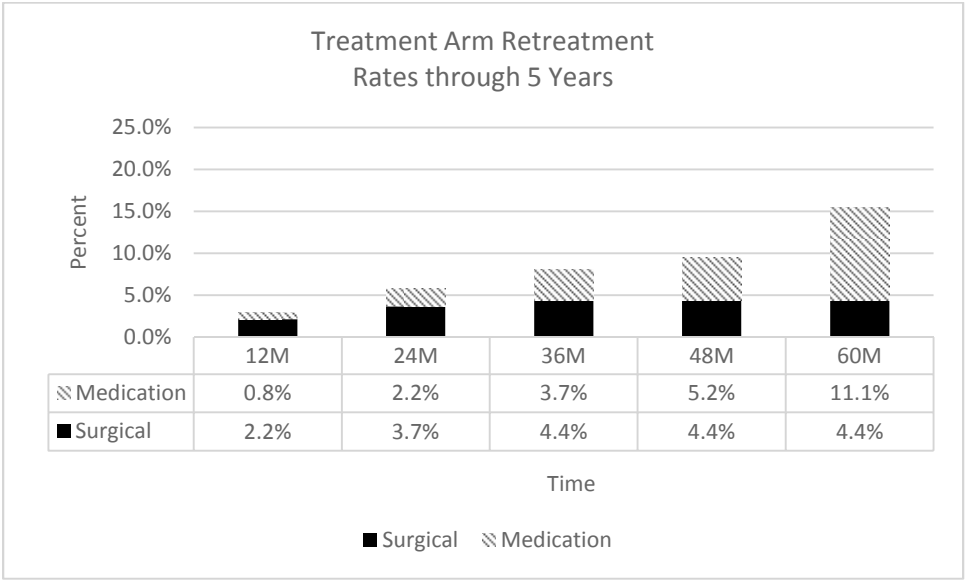


Figure 2(D) BPHII

Figure 2. Graphical representation of the the outcomes at the end of the 5 year study for Rezum water vapor thermal therapy, showing the results of both treatment and crossover arm. IPSS (A), IPSS Qol (B), Qmax (C), BPHII(D). Values are means and error bars represent 95% CI.

Figure-3.


Treatment Arm Retreatment
Rates through 5 Years
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Percent
12M
24M
36M
48M
60M
Medication
0.8%
2.2%
3.7%
5.2%
11.1%
Surgical
2.2%
3.7%
4.4%
4.4%
4.4%
Time
Surgical
Medication