PK™ TURP: A Technology Brief

INTRODUCTION: While new technologies have been introduced to treat BPH, few have demonstrated efficacious resolution of primary outcomes, while providing reduced complication rates and improvement in secondary outcomes. Bipolar electrosurgery has been utilized in many specialties to minimize tissue trauma and improve clinical outcomes. The PlasmaKinetic (PK™) TURP system (Gyrus ACMI, Southborough, MA) is an advanced bipolar electrode design driven by proprietary software in the SuperPulse generator to achieve hemostatic resection with minimal tissue trauma. Over the last 10 years, clinical research involving 23 studies and over 2,500 patients has consistently shown PK TURP to produce patient benefits in key outcomes. This review details the technical aspects of PK TURP that have delivered these improvements in the Gold Standard TURP.

MECHANISMS OF PK ELECTROSURGICAL DEVICES

Bipolar design incorporates the active and return poles on the same electrode (Figure 1) rather than the return pad used in monopolar TURP. Significantly lower voltages (220–320Vrms) can be used to push electrical current around the bipolar circuit. This is a fraction of the high voltages (1,000–3,000Vrms) used in monopolar designs. The effect is to reduce localized tissue damage, preventing charring and damage to underlying blood vessels that may subsequently slough off or open due to patient movement (Figure 2).

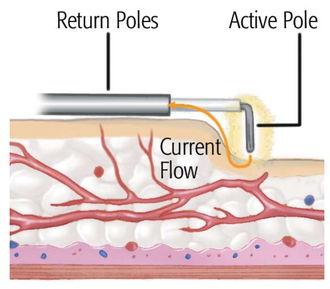

Figure 1: PK™ Electrical Current Flow

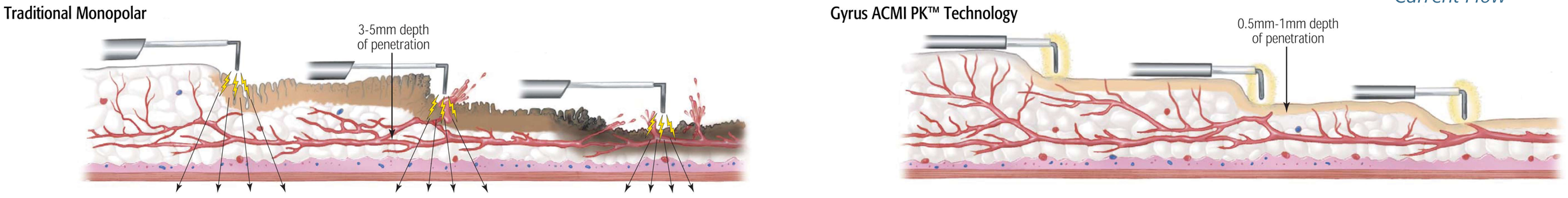

Figure 2: Deep tissue effects with monopolar TURP compared to hemostatic resection with PK™ TURP

PK CUT (YELLOW PEDAL)

A plasma corona is generated around the loop such that tissue molecules entering this highly energized field are vaporized creating a cutting effect. The PK waveform has been tuned to enable concomitant hemostasis during resection. When retraction of the loop is done at the appropriate speed, sufficient thermal energy remains on the tissue to enable coagulation of capillary bleeders (Figure 3). The effect gives clear, hemostatic resection but is sufficiently shallow to prevent irritative symptoms observed with laser technologies.

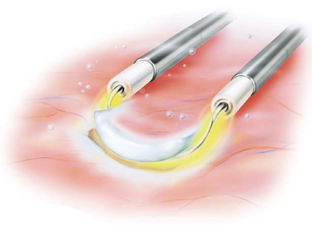

Figure 3: Plasma corona resulting in concomitmant hemostasis during PK TURP

Superpulse: To ensure rapid plasma fire off, the Superpulse generator incorporates a bank of capacitors to hold an electrical charge ready for the next activation. This allows operation under a range of conditions including high saline flow and high tissue impedance.

PURE COAGULATION (BLUE PEDAL)

To prevent plasma formation, the voltage is reduced (120Vrms) such that coagulation relies on tissue resistive heating. The appropriate depth of coagulation is achieved by firm application of pressure for sufficient time to control bleeders. A wide circumferential thermal zone compared to monopolar enables larger bleeders to be controlled, useful in both TURP and TURBT. The tissue effect achieved results in a moist white coagulum that will not slough off during the healing process unlike the charred dessicated tissue generated with monopolar electrosurgery.

HOW PK TECHNOLOGY IMPROVES CLINICAL OUTCOMES

Utilizing the low-voltage bipolar PK™ system results in a less traumatic tissue effect and improvement in clinical outcomes for PK TURP patients compared to monopolar TURP. The ability to achieve concomitant hemostasis during resection results in reduced blood loss (Figure 4), effecting less change in hemoglobin and hematocrit.[1–7] Clear post-operative irrigant results in less continuous bladder irrigation[1–7] and the ability to conduct day case PK TURP with earlier catheter removal than monopolar TURP.[15,33,34,49]

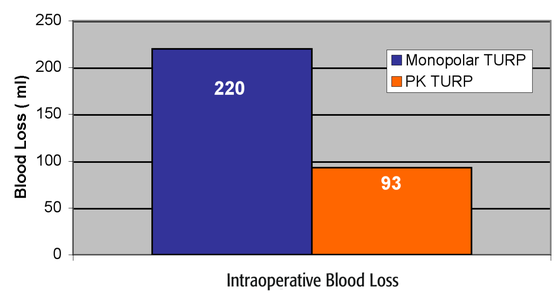

Figure 4: Intra-operative Blood Loss PK vs. Monopolar TURP

SAFETY

Irrigant: PK TURP utilizes saline irrigant instead of glycine, eliminating the 1.9% TUR syndrome reported with monopolar TURP.[1–7] Large gland sizes can now be approached, which limits the need for open prostatectomy in many cases.[51] Resident training is safer as the one-hour surgical time limit no longer applies.[16] However saline absorption in extended cases must be monitored.

Electrical Current Flow: Electrical pathway from active to the return pole incorporated on the electrode (Figure 1) minimizes the risk of sexual dysfunction due to electrosurgical current nerve and soft tissue damage. Erectile dysfunction for PK TURP is equivalent to microwave therapy at < 5%.[20]

Potential for thermal damage due to current passing along the urethra creating urethral strictures is also minimized and in reviewing over 2,500 patients in PK studies shows urethral stricture rates to be 0.9%, less than half that of monopolar TURP.[1–23]

Overall patient complication rates are significantly lower for PK TURP (11.0%) compared to monopolar TURP (18.3%) ($p<0.001$)[1–7] (Figure 5), demonstrating that the use of PK energy improves the safety of the Gold Standard procedure for treatment of BPH.

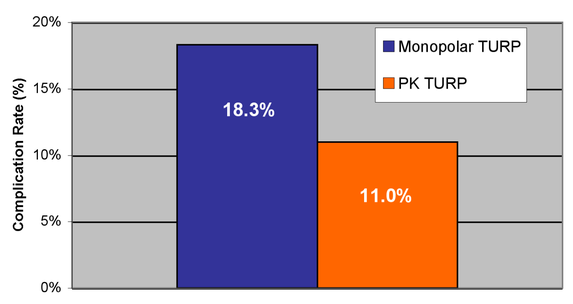

Figure 5: Patient Complication Rate PK vs. Monopolar TURP

CONCLUSIONS: Monopolar TURP has long been recognized as the only option for complete resolution of BPH symptoms. However this technology, developed in the 1960s, results in high complication rates and safety issues such as TUR syndrome. PK TURP delivers Gold Standard outcomes with significantly reduced complication rates by minimizing the localized tissue trauma. Day case PK TURP and early removal of catheter are further advantages that support the use of PK technology.

REFERENCES: See separate listing.