

The role of Vacuum Therapy in Penile Rehabilitation

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Prostate cancer is the most common solid-organ cancer in men and one of the leading causes of death.¹ With the early detection and radical prostatectomy, the 15-year overall actuarial cancer-specific survival rate has reached 90%.² Unfortunately, radical prostatectomy is associated with several quality-of-life issues, mainly urinary incontinence and erectile dysfunction.³ With technique improvements and the use of robotic procedures, incontinence rates drop to an acceptable level.⁴⁻⁶ However, the same cannot be said for erectile dysfunction since the incidence of erectile dysfunction after radical prostatectomy ranges from 10% to 100%.⁷

Erectile dysfunction following radical prostatectomy is thought to be secondary to damage to the cavernous nerves and the reduction of arterial inflow. The combination of nerve damage and decreased arterial inflow will cause hypoxia and ultimately lead to programmed cell death resulting in penile shrinkage.³

The concept of penile rehabilitation after radical prostatectomy is now widely accepted in clinical practice. The goals of penile rehabilitation are to improve penile oxygenation, prevent program cell death and promote early recovery of erection. Currently penile rehabilitation methods include the use of phosphodiesterase type 5 inhibitors, intracavernosal injection, vacuum erectile device or combination therapy. This brief review is focused on the role of vacuum therapy in penile rehabilitation.

Vacuum therapy utilizes negative pressure to distend the corporal sinusoids and to increase the blood inflow to the penis. The erection occurs after the sinusoids are filled with blood. An external constricting ring is then placed at the base of penis to prevent blood outflow and the erection is maintained for sexual intercourse.⁸ The concept of vacuum therapy for erectile dysfunction goes back to 1874 to the credit of Dr. John King, an American physician.⁹

Vacuum therapy is gaining recognition as a rehabilitative tool, though using the constricting ring is not recommended when vacuum therapy is used for rehabilitation.³ In our rehabilitation program, vacuum therapy is used daily to create two or three erections in 10-15 minutes.¹⁰ This ability to ensure multiple erections on a daily basis is an advantage of vacuum

therapy since the average man obtains three to six erections per night during the rapid-eye-movement sleep.¹¹ We do not know how many erections at a given time are required to maintain the health of erectile tissue, nor do we know the number of erections required per week for penile rehabilitation. But we believe the use of vacuum therapy as a rehabilitation modality can maximize the number of erections, a benefit that other current rehabilitation methods cannot match.

Recent studies have shown that early rehabilitation with vacuum therapy improves both patient and partner sexual satisfaction and allows earlier return of spontaneous erection.^{12,13} Vacuum therapy can also prevent penile shrinkage and maintain penile length.¹³ Compared to the penile injection, vacuum therapy has a better compliance rate.¹⁰ The question of when to initiate vacuum therapy has been debated. Early intervention with vacuum therapy (one month post nerve-sparing radical prostatectomy) had a statistically higher erectile function recovery and penile length maintenance when compared to traditional intervention (6 months after surgery).¹⁴ However, other researchers reported that delayed vacuum therapy could also be beneficial in the recovery of penile length and erectile function.¹⁴

A possible criticism of vacuum therapy as a rehabilitation method is that the mechanism for improving spontaneous erection is unknown. Blood gas analysis to evaluate the origins of blood for erection with the use of vacuum therapy partly addressed this issue.¹⁵ Blood gas analyses were obtained from the corpora cavernosa with vacuum-therapy-induced erection immediately after application of a constriction ring. The measurements were repeated 15 and 30 minutes later with the constriction ring in place. The blood gas results from the blood from the corpora cavernosa were compared with arterial and venous blood from the patient's arm. The results showed that mean O₂ saturation of corporeal blood immediately after vacuum-therapy-induced erection was 79.2%, compared with 94.5% in arterial blood and 54.7% in venous blood. These findings indicate that 58% of blood with vacuum-therapy-induced erection was arterial and 42 % of blood was venous in origin. The O₂ saturation decreased significantly after 30 minutes with the ring in place. Because of this finding, we do not recommend using the ring when vacuum therapy is used for penile rehabilitation purpose. Arterial blood may not only provide oxygen to the corporal tissues, it may also carry other nutrients, such as certain growth factors, to the tissues.³ We are currently working in an animal model to explore the molecular mechanism of vacuum therapy in penile rehabilitation as an animal specific vacuum device. Our preliminary results are very exciting.

Vacuum therapy also appears to be more cost-effective compared with frequent use of oral medications or frequent penile injections.¹⁶ However, this method requires active patient participation in the rehabilitation process relative to taking a pill.¹⁶ It may also require a partner's active participation.

This therapy can also be used for patients with erectile dysfunction due to non-nerve sparing radical prostatectomy, radical cystectomy, rectal cancer surgery, radiation and cryotherapy for prostate cancer.¹⁶ It may or may not improve the recovery of erectile function in these patients, but it will maintain penile size and prevent penile shrinkage.¹⁶

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