



## 미세수술기법을 이용한 완전 절단된 성인 음경의 재접합 치험 2예

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# Replantation of the Completely Amputated Adult Penis: Two Case Reports Using Microsurgical Technique

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Traumatic penile amputation is a rare but catastrophic event, so all possible attempts should be made for salvage. Recent use of microsurgical methods have the potential to reduce complications, but to date, most reported surgical successes have focused on survival and were not complication-free. To restore baseline penile function, normal anatomic structure must be re-established. We have attained flawless anatomic replantation of the adult penis and describe two case reports where complications were eliminated by a microsurgical approach. One patient was a 38-year-old schizophrenic, and the other was a 43-year-old chronic alcoholic. Under microscopy, normal function and aesthetics were restored, without complications. Rather than viability, the most critical issue is a return to normal status. Microsurgical replantation is thus the treatment of choice in instances of penile amputation, and is aimed at restoring normal anatomy and function.

**Key Words:** Penis, Replantation, Amputation, Microsurgery

Penile amputation is an extremely rare traumatic event. The majority of cases involve adult self-mutilation due to psychological problems or surgical mishaps during circumcision of infants<sup>1,2</sup>. Prior to the advent of microsurgery, survival of the replanted penis depended on the adequacy of sinusoidal blood flow to re-approximated penile tissues<sup>1</sup>. Consequently, tissue necrosis, urethral stricture, loss of sensation, erectile dysfunction was often occurred.

Microsurgical replantation has the potential to reduce

such complications, but most of the reported successes (approximately 30 cases) have focused on survival, rather than meticulous technique, and were not free of postoperative complications. To restore baseline penile function, the intrinsic anatomy of the penis must be maintained. We have achieved complete anatomic restoration of a severed adult penis using a microsurgical technique that eliminates complications. The details are described here in two case reports. Normal function and aesthetics resulted in each case.

Received August 9, 2019, Revised October 10, 2019, Accepted November 5, 2019

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## CASE REPORT

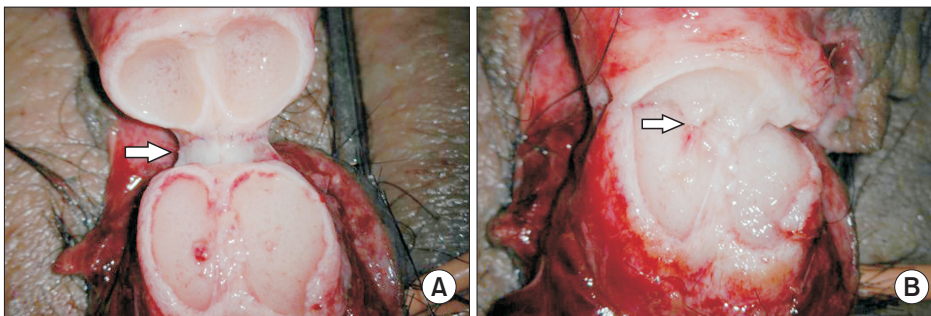
### 1. Surgical technique

Under general anesthesia, blood loss from the penile stump was controlled by wrapping the base of the penis circumferentially with a small penrose drain or rubber relaton catheter, secured by a hemostat; and percutaneous suprapubic cystostomy was performed for urinary diversion. Initially, the amputated segment and corresponding edge of penile remnant were carefully examined at high-power under a surgical microscope, tagging all arteries, veins, and nerves identified with 9-0 or 10-0 nylon suture. A 16 Fr Foley catheter inserted into urethra (severed and residual) and passed into the bladder functioned as a rigid support during surgery. The study was performed in

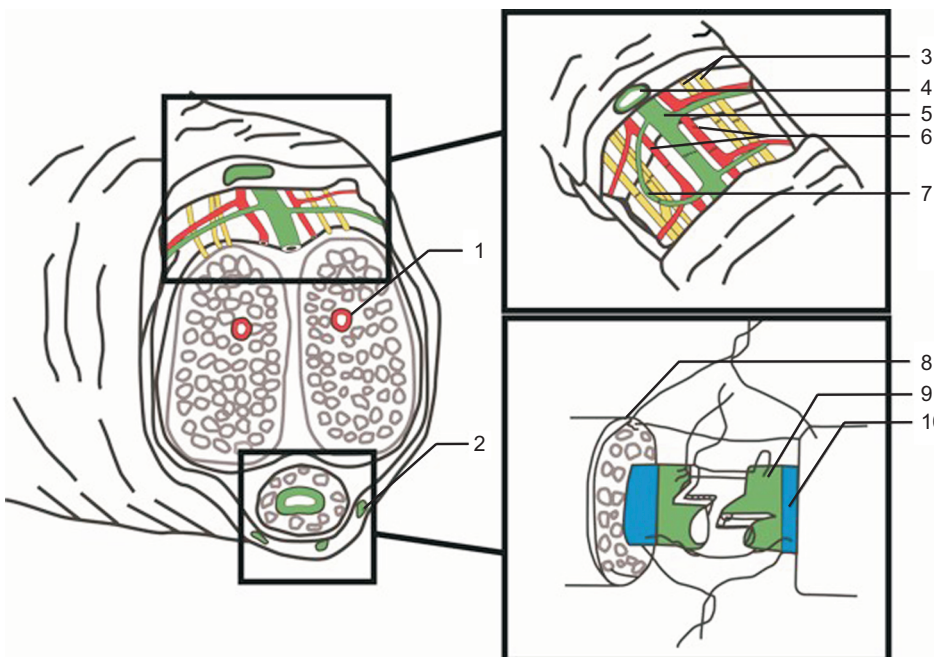
accordance with the principles of the Declaration of Helsinki. The patient provided written informed consent for the publication and the use of her images.

A 3-layer anastomosis of urethra was performed first. Following two z-plasty maneuvers with opposing 3-mm flaps (3 and 9 o'clock), vertical mattress suturing (6-0 polydioxanone [PDS™II]) of the mucosa was done. The muscular layer was sutured, avoiding damage to the sinusoidal spaces of spongiosum (Fig. 1, 2)<sup>3</sup>.

Next, the lower tunica albuginea (of corpora cavernosa) and the septum penis were repaired (4-0 PDS™II), anastomosis (10-0 nylon) of two cavernosal arteries (0.5 mm) which were situated in the center of corpus cavernosum took place under high-power microscopy, and repair of tunica albuginea and septum penis resumed for full restoration (Fig. 1). Any errors at this juncture could be a



**Fig. 1.** (A) Anastomosis of urethra and corpus spongiosum was performed with Z-plasty and 3-layered suture technique. (B) Anastomosis of cavernosal artery which is situated in the center of corpus cavernosum.



**Fig. 2.** Schematic illustration of operative method (1: cavernosal artery or deep artery of penis, 2: superficial vein beneath the dartos fascia, 3: dorsal penile nerves, 4: superficial dorsal vein of penis, 5: deep dorsal vein of penis, 6: dorsal arteries of penis, 7: circumferential vein or circumflex vein, 8: fibrous capsule of corpus spongiosum, 9: urethral mucosa, 10: urethral muscular layer). Cited from the article of Kim et al. (J Korean Soc Plast Reconstr Surg 2004;31:127-32)<sup>3</sup>.

source of postoperative hematoma.

Two dorsal penile arteries (1 mm) and a deep dorsal vein (1.5 mm) were also repaired (10-0 nylon), as well as two proximal and two distal circumferential veins. Dorsal nerve bundles in the vicinity of deep dorsal and circumferential veins were identified for repair via epineural suture (10-0 nylon) (Fig. 2)<sup>3</sup>. Buck's fascia (deep penile fascia) was restored (5-0 PDS<sup>TM</sup>II), as were other veins (10-0 nylon), including a superficial dorsal vein (3 mm) and superficial veins beneath dartos fascia (superficial penile fascia). Dartos fascia and skin were repaired (5-0 polyglactin 910 [Vicryl<sup>TM</sup>]).

Prostaglandin E1 (5 mcg/mL/day), low molecular weight dextran (500 mL/day) and prophylactic antibiotics were administered intravenously for 5 days.

## 2. Patient 1

A 38-year-old male suffering from schizophrenia self-amputated his penis in a suicide attempt and was hospitalized 7 hours later. At presentation, the distal shaft (three-quarters) was completely amputated (Fig. 3). Warm ischemic time was approximately 7 hours, and cold ischemic time was 2 hours (total ischemic time, 9 hours).

Microsurgical replantation was performed as described above. Four arteries (2 dorsal penile and 2 cavernosal arteries), 6 veins (1 deep dorsal, 1 circumferential dorsal, 1 superficial dorsal, and 3 superficial veins beneath dartos fascia), and 5 dorsal penile nerves were repaired (Fig. 2)<sup>3</sup>.

Mild edema developed during the first 2 postoperative

days but resolved within five days, and no other complications occurred (Fig. 3). Following Foley catheter removal 2 weeks later, natural urinary volume (21 mL/sec) was within normal range by urine flowmetry, and a retrograde urethrogram (postoperative day 28) showed no evidence of stricture or fistula (Fig. 4). Nocturnal penile tumescence (NPT) tested at 3 weeks indicated three episodes of poorly sustained but rigid nocturnal erection (mean duration, 9 minutes). Repeat testing at 3 months revealed two episodes of well-sustained, completely rigid nocturnal erection (mean duration, 45 minutes) (Fig. 5). Patient's urethral patency was adequate for comfortable voiding.



Fig. 4. A retrograde urethrogram taken at 28 days shows no evidence of stricture or fistula.

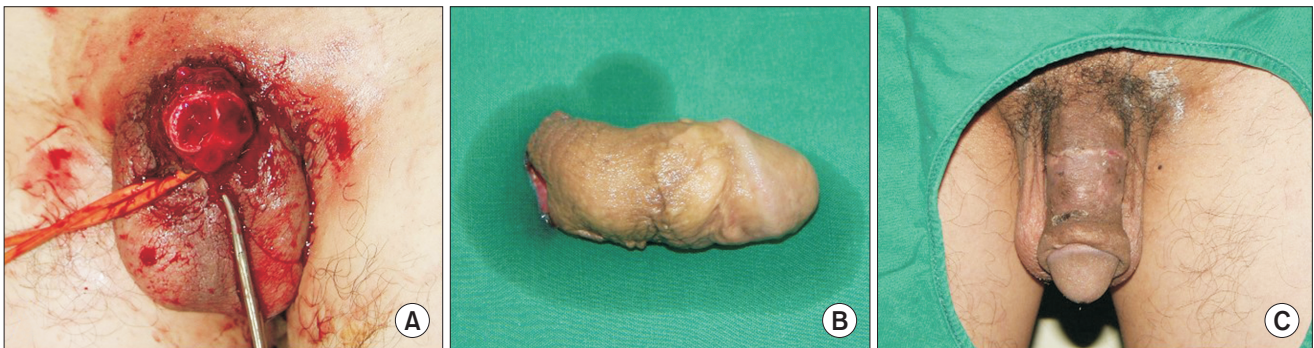
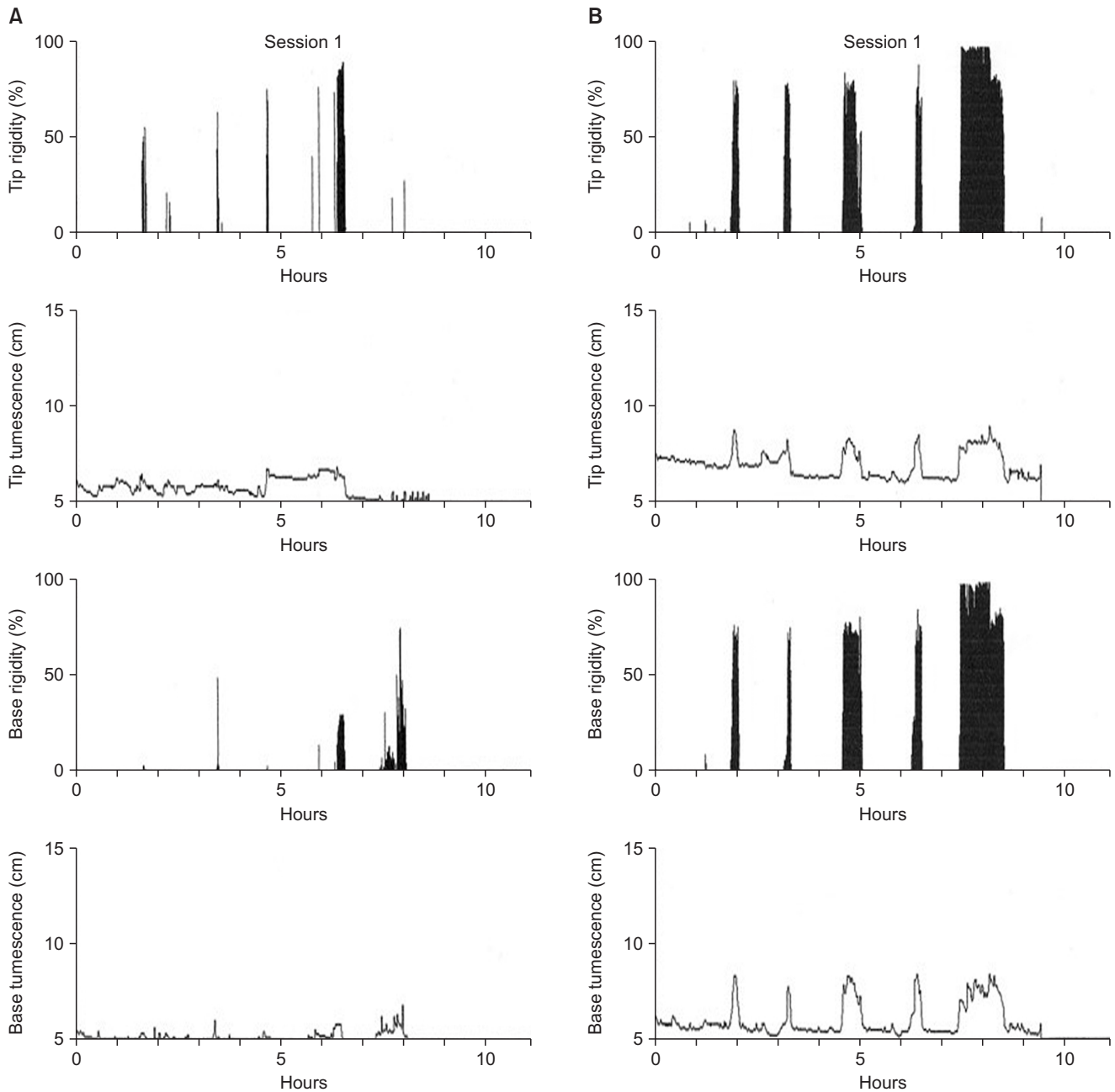


Fig. 3. (A) The proximal penile stump was wrapped with rubber netaon catheter for bleeding control. (B) The amputated penis. (C) Postoperative appearance of the penis at 28 days.



**Fig. 5.** (A) Nocturnal penile tumescence test (NPT) checked at 3 weeks showed 3 episodes of poorly sustained and rigid nocturnal erections and mean erection duration was 9 minutes. (B) NPT checked at 3 months showed two episodes of well-sustained, completely rigid nocturnal erections and mean erection duration was 45 minutes.

### 3. Patient 2

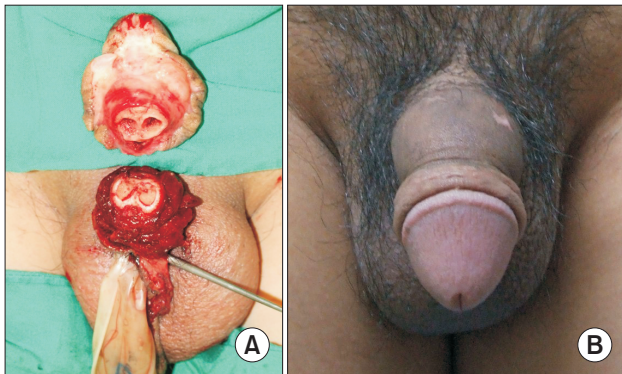
A 43-year-old male with chronic alcoholism severed his penis with knife in a state of alcoholic delirium during intended detoxification. He has hospitalized 3 hours later. At presentation, the distal three-quarters of penile shaft was severed obliquely (Fig. 6). Vital signs were unavail-

able. Warm ischemic time was approximately 3 hours, and cold ischemic time was 1 hour (total ischemic time, 4 hours).

Microsurgical replantation was performed as described above. Four arteries (2 dorsal penile and two cavernosal arteries), 6 veins (1 deep dorsal, 1 superficial dorsal, and 4 superficial veins beneath dartos fascia), and 6 dorsal

penile nerves were repaired (Fig. 2)<sup>3</sup>.

Mild subcutaneous edema developed during the first 3 postoperative days, resolving after five days. Follow-

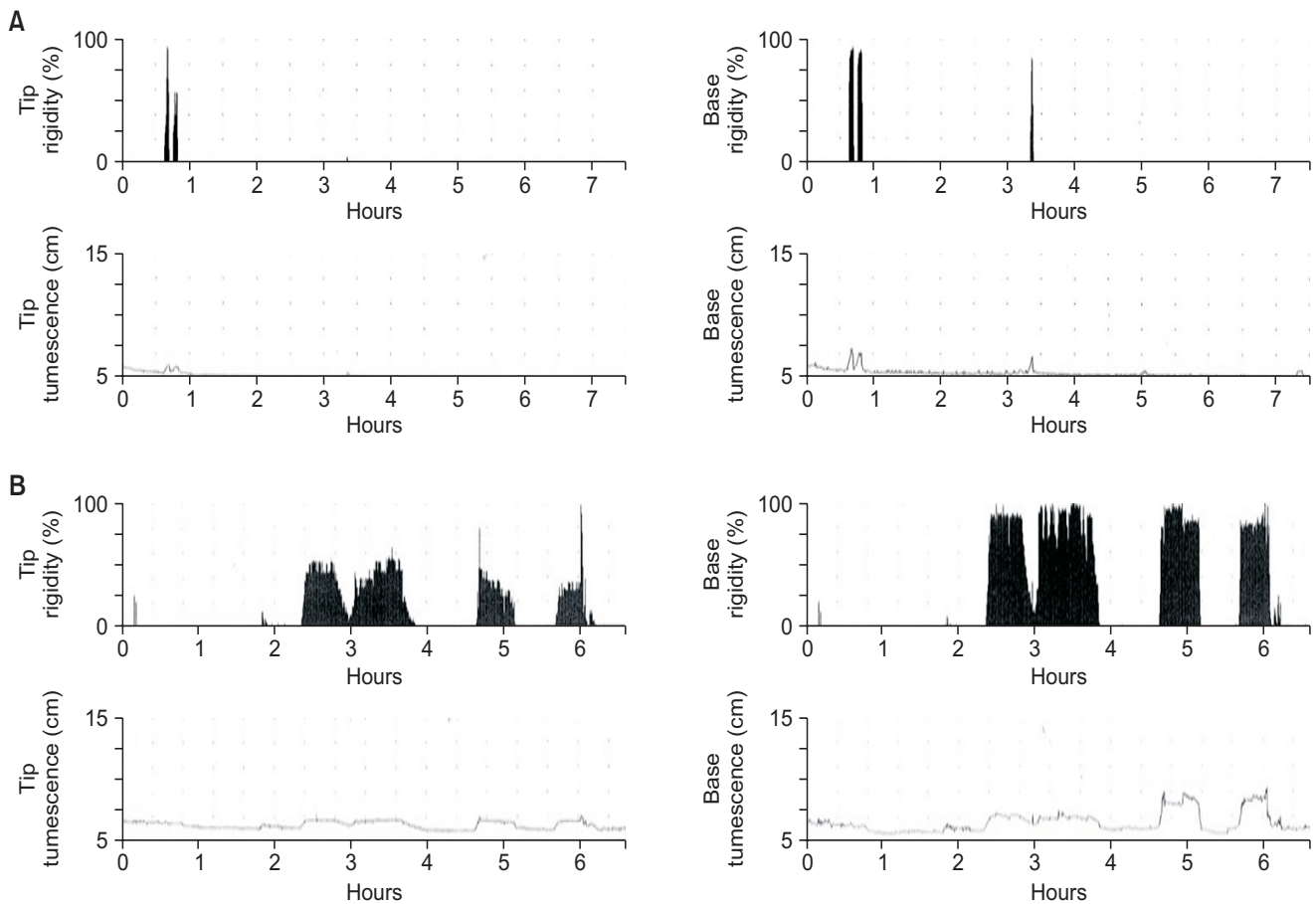


**Fig. 6.** (A) Preoperative photograph of complete amputated penis. (B) Postoperative appearance of the penis at 30 days.



POD 6 weeks

**Fig. 7.** A retrograde urethrogram taken at 30 days shows no evidence of stricture or fistula. POD: postoperative day.



**Fig. 8.** (A) Nocturnal penile tumescence test (NPT) checked at 3 weeks showed 2 episodes of poorly sustained and rigid nocturnal erections and mean erection duration was about 12 minutes. (B) NPT checked at 5 months showed five episodes of well-sustained, completely rigid nocturnal erections and mean erection duration was 101 minutes.

ing Foley catheter removal 2 weeks later, natural urinary volume (18 mL/sec) was within normal range by urine flowmetry. Retrograde urethrogram (postoperative day 30) showed no evidence of stricture (Fig. 7). NPT tested at 3 weeks indicated two episodes of poorly sustained but rigid nocturnal erection (mean duration, 12 minutes). Repeat testing at 5 months revealed five episodes of well-sustained, completely rigid nocturnal erection (mean duration, 101 minutes) (Fig. 8). Patient's urethral patency was adequate for comfortable voiding. Three months later, the patient was capable of normal sexual relations with his wife.

## DISCUSSION

The objective of penile replantation is preservation of penile length, erectile function, and upright voiding capacity. A severed penis should be immediately and expeditiously repaired to prevent ischemia of the amputated segment. Amputations of the glans and distal penis may be viewed as composite grafts, treated by anastomosis of urethra and corpora, and subsequent suturing of skin. Such maneuvers rely on adequate sinusoidal blood flow and do not require a microvascular approach for success<sup>2</sup>. However, an array of complications, including skin necrosis, venous congestion, urethral fistula or stricture, poor sensation, and incomplete erection or impotence, have occurred postoperatively<sup>4</sup>. The first successful microsurgical replantation of the penis was performed by Cohen<sup>5</sup> in 1976. It has become increasingly clear that outcomes are significantly improved by microsurgery.

The maximum ischemic time for return of testicular endocrine function is reported to be approximately 6 hours but for viability of a severed penis, the window of time is longer<sup>6</sup>. In addition, prolonged ischemia of a penile stump (18 hours) in a 4-year-old child has been reported and was not prohibitive, although the severed penis was cooled while ischemic to the extent that treatment for frostbite was needed<sup>7</sup>. In patient 1, duration of ischemia overall (including intraoperative period) was 10 hours 30 minutes, and no complications ensued. It is very likely that the actual ischemic insults incurred have been longer

than published reports reflect. Nevertheless, ischemic time is the primary determinant of subsequent complications.

When initiating penile replantation, urethral repair should be performed first. An accepted method is one-layer suturing of urethra and corpus spongiosum, but this can easily lead to urethral stricture or fistula. Alternatively, two layer repair for improving viability, a spatulated technique, and an oval-end termino-terminal anastomosis have been devised to prevent urethral complications<sup>8</sup>. In the patients treated here, a three-layer repair with double opposing Z-plasty was used. Following double opposing z-plasty and suturing of mucosa, the muscular layer of urethra and fibrous capsule of corpus spongiosum were repaired in sequence, avoiding damage to the sinusoidal spaces of spongiosum. Above all, the integrity of blood supply must be assured to prevent ischemia or venous congestion and secondary necrosis.

There is currently no consensus on the number of arteries and veins it is necessary to repair during penile replantation for adequate perfusion or viability of the penis; but according to some sources, at least one dorsal penile artery and one deep dorsal vein may suffice for penile viability<sup>7</sup>. Anatomic restoration is paramount to regain baseline function, so as many vessels as feasible should be repaired. The patency of the cavernosal artery is the most important for erectile function. In instances where the cavernosal artery was incompletely repaired, results were poor, possibly owing to technical difficulties<sup>9</sup>. Cavernosal arteries of both patients here were completely repaired, restoring normal erectile function.

Rigorous repair of venous channels is also recommended to reduce postoperative edema and necrosis of the glans and foreskin<sup>10</sup>. In the present circumstances, six veins, including superficial and deep dorsal branches, were repaired, resulting in mild edema only. Anastomosis of the superficial vein beneath dartos fascia is especially important to prevent venous congestion of subcutis and skin necrosis.

Dorsal penile nerves distributed about the penile shaft within Buck's fascia innervate distal shaft, prepuce, and glans penis, are largely responsible for tactile and erog-

enous penile sensation. Dorsal neuroorrhaphy is therefore essential for restoration of erectile/sexual capacity. In these patients, 5-6 dorsal penile nerve fascicles were repaired, with sensory impulses first to recover.

In conclusion, the goal of penile replantation is both functional and cosmetic, assuring penile length sufficient for normal erection and urethral patency adequate for comfortable voiding. We have presented two instances of successful microsurgical penile replantation after complete amputation. In this setting, a return to baseline status (as opposed to viability) is the most critical issue. Microsurgical replantation is thus the treatment of choice, and is aimed at restoring normal anatomy and function.

## CONFLICTS OF INTEREST

The authors have nothing to disclose.

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## 미세수술기법을 이용한 완전 절단된 성인 음경의 재접합 치험 2예

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외상성 음경의 절단은 드물지만 발생 시 절망적인 사건이기 때문에 이를 살리기 위한 가능한 모든 방법이 시도되어야 한다. 최근 미세수술법의 발전으로 이를 이용하면 합병증을 줄일 수 있지만 현재까지 보고된 대부분의 수술 성공 사례는 생존에 초점을 맞추고 있으며 합병증이 없는 것은 아니었다. 음경기능의 회복을 위해서는 정상적인 해부학적 구조를 확실히 해야 한다. 우리는 두 개의 증례 보고를 통하여 미세수술적 접근을 통한 성인 음경의 완벽한 재건에 대하여 보고하고자 한다. 각각 38세의 정신분열증 환자와 43세의 만성 알코올 중독환자의 증례이며, 현미경 하 음경의 기능적 및 미적 회복에 성공하였다. 생존뿐만 아니라 정상상태의 복구를 중요한 문제로 생각하였고, 미세수술적 접근이 음경 절단의 기능적 및 해부학적 회복에 있어 좋은 치료 방법이 될 것이라 생각한다.

**색인단어:** 음경, 재접합술, 절단, 미세수술

**접수일** 2019년 8월 9일 **수정일** 2019년 10월 10일 **게재확정일** 2019년 11월 5일

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