

Dynamic Penile Cavernosa Reconstruction using Bilateral Innervated Gracilis Muscle: A Preclinical Investigation

Zhuming Yin, MD; Bingjian Xue, MM; Liqiang Liu, MD*

*Corresponding author

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BACKGROUND: Various surgical procedures have been designed for structural penile reconstruction. Unfortunately, few method yields satisfying sexual function without rigid graft. Given its kinetic function and volumetric filling properties, the gracilis muscle can be recruited with the neurovascular pedicle as a substitute for cavernosum in penile reconstruction.

METHODS: Mongrel female dogs (17.4 ± 2.2 kg) were assigned to control ($n=3$) and treatment group ($n=11$). Bilateral gracilis muscles were dissected and detached from proximal and distal insertions with neurovascular pedicles, and transferred to pubic area as bilateral cavernosa. The urethra was reconstructed by scrolling the skin attached to the left gracilis flap. The outer layer of the penis was formed by an abdominal flap, with the anterior rectus fascia as the tunica albuginea (Figure 1). The animals were reanesthetized 7 months postoperatively. The dimension and stiffness of the reconstructed penises at rest or erection were measured by electrostimulation on the nerve respectively, and the muscular fatigue-resistant curve (MFRC) was obtained. The canines were then euthanized, and the reconstructed penises were harvested and examined by hematoxylin-eosin, Masson trichrome, Sirius red, and immunohistochemistry staining.

RESULTS: Ten reconstructed penises survived completely except for one with partial necrosis because of self-bite. The length and diameter of reconstructed penises were 8.8 ± 0.6 cm and 4.0 ± 0.5 cm at rest, 10.4 ± 1.0 cm and 4.2 ± 0.4 cm at erection. The erection stiffness was determined as grade 3 or 4 according to a four-point scale¹. The MFRC indicated the erection can last for 30 minutes by tetanic contraction of the transferred gracilis muscle, which is sufficient for sexual intercourse. Histological analyses of reconstructed penises revealed nearly normal microstructure and more collagen content, while no significant difference was found in collagen types. Moreover, reduced fatigue-prone (type II) muscle fibers were observed in the treatment group by anti-myosin immunostaining with concomitant increment of fatigue-resistant (type I) fibers.

CONCLUSIONS: The bilateral innervated gracilis muscle transfer enables dynamic penile cavernosa reconstruction without additional graft in canine models with satisfactory erection dimension, stiffness and duration for sexual function, which might be applied into clinical practice.

REFERENCE:

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FIGURE LEGEND:

Figure 1. Structure of the reconstructed penis.

