Animal Tissue Growth Arouses Hope For Human Surgical Procedures

In an advance that could one day enable surgeons to reconstruct and restore function to damaged or diseased penile tissue in humans, researchers at Wake Forest University Baptist Medical Center's Institute for Regenerative Medicine have used tissue engineering techniques to completely replace penile erectile tissue in animals.

In the online early of the *Proceedings of the National Academy of Sciences*, the researchers report success using cells from rabbits to grow replacement penile erectile tissue for the animals in the laboratory. After implantation with the replacement tissue, the rabbits had normal sexual function and produced offspring. This is the most complete replacement of functional penile erectile tissue reported to date.

Anthony Atala, M.D. and institute director, stated, “Our hope is that patients with congenital abnormalities, penile cancer, traumatic injury and some cases of erectile dysfunction will benefit from this technology in the future.”

Reconstructing damaged or diseased penile erectile tissue has traditionally been a challenge because of the tissue's unique structure and complex function. There is no replacement for this tissue that allows for normal sexual function. Various surgeries have been attempted, often multi-stage procedures that can involve a silicone penile prosthesis, but natural erectile function is generally not restored.

The scientists first harvested smooth muscle cells and endothelial cells, the same type of cells that line blood vessels, from the animals' erectile tissue. These cells were multiplied in the laboratory. Using a two-step process, the cells were injected into a three-dimensional scaffold that provided support while the cells developed. As early as one month after implanting the scaffold in the animal's penis, organized tissue with vessel structures began to form.

The cells were injected into scaffolds on two separate days, enabling them to hold almost six times as many smooth muscle cells as in the previous studies – which the scientists believe was a key to success. “Increasing the density of smooth muscle cells led to normal erectile pressures within the tissue,” said Atala, who is also a professor and chair of urology at Wake Forest Baptist.

Functional testing of the implanted tissue showed that vessel pressure within the erectile tissue was normal, that blood flowed smoothly through it, that the response to nitric oxide-induced relaxation was normal as early as one month after implantation, and that veins drained normally after erection.

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