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ADIPOSE-DERIVED STEM CELL TRANSPLANTATION FOR THE TREATMENT OF STRESS URINARY INCONTINENCE

Hypothesis / aims of study
To compare the degree of urinary incontinence before and after adipose derived stem cell (ADSC) treatment and to study the proliferation of ADSCs in the tissue stress urinary incontinence (SUI) rat model.
Study design, materials and methods
Adult female SD rats were used for the SUI animal model. The ADSCs were isolated from the inguinal fat and were cultured and purified. Rats were randomly assigned to transplant Group I (n=20) injected with ADSCs and control Group II (n=16) injected with culture medium without serum. Bladder pressures were measured during the filling period using a urodynamic instrument. Ultrastructural analysis of the striated urethral sphincter was performed using the electron microscope.
Results
In Group I the bladder leak point pressure (LPP), maximum bladder volume, maximum urethral closure pressure, and functional urethral length were significantly increased after cell transplant compared to before($p < 0.05$), (Table 1). Ultrastructural analysis of before and after treatment showed significant improvements in filaments, sarcomere, sarcoplasmic reticulum, and mitochondria (Figure 1 and 2). We also observed a clear urethral striated muscle. No obvious chronic inflammation or immune rejection was observed.
Interpretation of results
Stem cells have been used for tissue and organ reconstruction with recent development of tissue engineering and cell therapy techniques. In recent years, the injection of muscle-derived stem cells around the urethra has been used to promote regeneration and repair of the urethral sphincter【1】. However, muscle-derived cells are hard to obtain and their harvest rate is low, having limited clinical application. Under these circumstances fibroblast-like cells can easily be obtained from human adipose tissue aspirates【2】, they have a high harvest rate, and their self-renewal ability and differentiation potential are similar to those of muscle-derived stem cells. Degeneration such as atrophy and deformation exist in the pelvic floor muscle and urethral sphincter of patients with stress urinary incontinence. The contraction and support of the pelvic floor muscles and the urethral sphincter could be improved if ADSCs differentiate into muscle cells when transplanted. This method could become a future treatment for women with SUI.

Table1. Urodynamic results of rat SUI model before and after ADSC transplantation

	Group I*		**Group II****	
	Before	After	Before	After
MBV (ml)	1.21±0.50	2.17±0.42	1.31±0.22	1.24±0.63
BLPP (cmH_2O)	15.14±7.31	23.19±9.71	14.45±9.04	15.19±7.86
MUCP (cmH_2O)	12.65±0.91	16.80±2.51	9.72±1.23	9.67±1.38
FUL (cm)	1.04±0.31	2.11±0.40	0.85±0.22	1.00±0.31

Maximum bladder volume, MBV; Bladder leak point pressure, BLPP; Maximum urethral closure pressure, MUCP; Functional urethra length, FUL. * The changes in the urodynamic indexes were significant in Group I before and after treatment ($P < 0.05$). * * There were no significant differences in the urodynamic indexes in Group Ⅱ before and after treatment ($P > 0.05$).

Figure 1: Ultrastructural characteristics of urethral striated muscle in the female rat SUI model

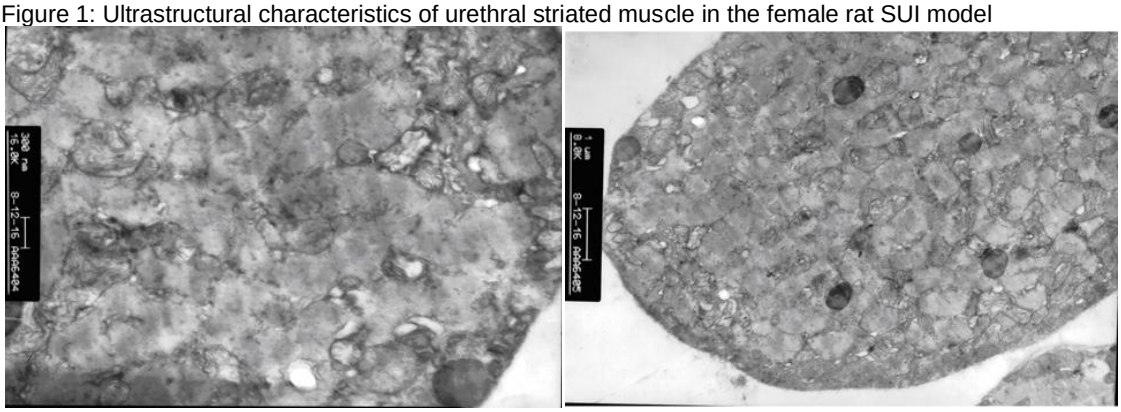
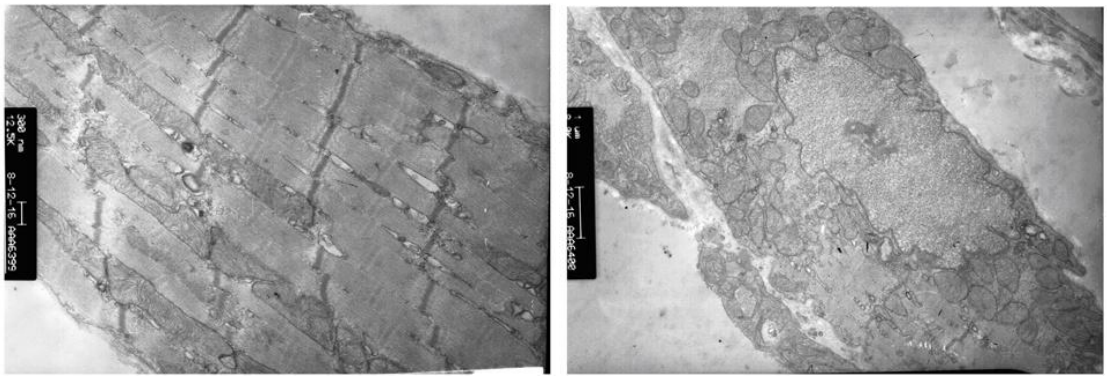


Figure 1: When rats were injected with DMEM culture medium without serum , the urethral striated muscle cell show rupture, degeneration, and atrophy. The muscle cell structure is disordered. The sarcoplasmic reticulum is dilated and the mitochondria is swollen. There is a decrease in the number of mitochondrial crests and an increase in the lysosomes.

Figure 2: Ultrastructural characteristics of urethral striated muscle in the female rat SUI model with ADSCs injection



After ADSCs injection urethral striated muscle cells were arranged regularly and had a clear structure. There are significant changes observed in the structures of the mitochondrial crest and membrane. The matrix density increased and the sarcoplasmic reticulum was not dilated.

Concluding message

This study showed that the injection of ADSCs around the urethra of female rats could improve the function of the striated urethral sphincter. The ADSC transplantation for the reconstruction of the pelvic floor tissue could be used in the future for the treatment of SUI.

References

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What were the subjects in the study?	**ANIMAL**
Were guidelines for care and use of laboratory animals followed or ethical committee approval obtained?	**No**
Statement that no ethical approval was needed	**no ethical approval was needed**