

THREE-DIMENSIONAL VIRTUAL-REALITY RECONSTRUCTION OF PELVIC FLOOR STRUCTURE FOR PATIENTS WITH FEMALE STRESS URINARY INCONTINENCE

Hypothesis / aims of study

Urinary incontinence is a common disease of medium old age in women which is a problem with healthy globalization.(1) Stress urinary incontinence(SUI) is the most common type, which seriously endanger the large women the mind and body health. The organs and muscles of the pelvic floor have complex three-dimensional (3D) structures and interact in a complex fashion to maintain continence. When they do not function properly, incontinence results. Virtual-reality technology was developed to improve visualization of pelvic organs and muscles in 3D(2). This study was aimed to recommend Virtual-reality technology as a new method to research the relation between the morphologic alterations of the bladder, urethra and levator and SUI.

Study design, materials and methods

Twenty continent reference subjects and 20 SUI patients underwent MR imaging. Three-dimensional Virtual-reality models of the pelvic bones, bladder, urethra, obturator internus muscle and levator were created. Using 3D models, We compared the two groups for degree of the vesicourethral angle(α_r, α_s), Urethral tilt angle(β_r, β_s) and mobility of the bladder neck (Mu)at rest and during Valsalva effort at maximal straining. we still compared the two groups for the volume of levator (Levvol) and the levator hiatus height and width(LHH) at rest(figure1).we still research the relationship between mobility of the bladder neck and the volume of levator in SUI.

Results

Funneling at the bladder neck and shorter urethra were found in two patients with SUI. The group with SUI had a greater vesicourethral angle (141.18°vs113.38°) (figure2,3), urethral inclination angle (36.27° vs21.96°)with strain.the mobility of the bladder neck(15.67vs 7.87mm) the levator hiatus height (LHH) ,width , and smaller the volume of levator than did the women who were continent ($p < 0.05$).(table 1) There is a negative relation between mobility of the bladder neck and the volume of levator in SUI.

Interpretation of results

This study clearly shows that for patients with SUI, urethral hypermobility results from weakening of urethra supporting structures leading to downward displacement and rotation of the urethra which will lead to greater vesicourethral angle ,urethral tilt angle and mobility of the bladder neck. In intrinsic sphincter deficiency, there is malfunction of the sphincter itself, which leads to an open bladder neck at rest and a low Valsalva leak point pressure, the weakness and laxity of levator leads to larger the levator hiatus height ,width , and smaller volume of levator.

Concluding message

Virtual-reality technology is a new, innovative, effective method to reveal significant morphologic alterations of the urethra and supporting structures. Virtual-reality technology can show difference in levator volume, shape, and integrity across groups of asymptomatic and SUI.

Table 1. Comparison of urethral, bladder and levator parameters between the groups.

	SUI	Asymptomatic
	Mean \pm SD	Mean \pm SD
ar (deg)	121.47 \pm 6.15°	101.49 \pm 4.73°
as (deg)	141.18 \pm 7.81°	113.38 \pm 2.69°
β_r (deg)	23.33 \pm 4.68°	9.29 \pm 2.93°
β_s (deg)	36.27 \pm 4.71°	21.96 \pm 3.81°
Mu(mm)	15.67 \pm 2.36	7.87 \pm 1.33
LHH (mm)	51.44 \pm 0.99	47.18 \pm 1.05
LHW (mm)	36.03 \pm 1.36	27.42 \pm 0.83
Levvol(ml)	27.58 \pm 3.78	45.89 \pm 1.05

Each value represents the mean \pm SEM * P<0.05 versus control

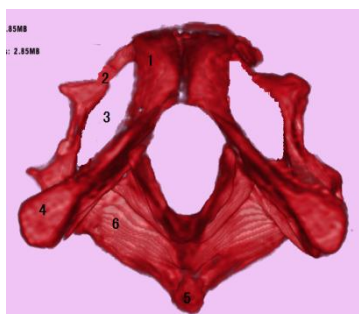


Figure 1.

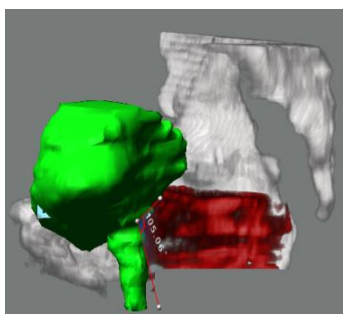


Figure 2.

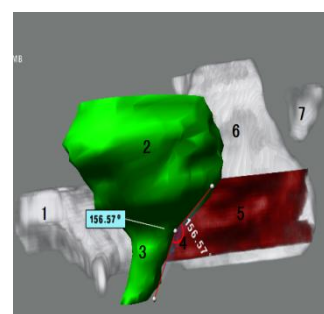


Figure 3.

Figure 1: Reconstructed pelvis and levator. 1: symphysis; 2:pubic bone 3: obturator 4:Ischia 5: coccyx 6:levator: the height of levator (longer black line) ,the width of levator (shorter black line).Figure 2: The vesicourethral angle strain in the control group ;(105.08°)Figure 3:The vesicourethral angle 156.57° > 115° strain in SUI(Reconstructed pelvis and pelvic organs. 1: symphysis; 2:bladder3:urethra; 4:the vesicourethral angle 5;obturator internus ; 6:Iliac;7: coccyx.)

References

1. Minassian VA, Drutz HP, Al-Badr A. Urinary incontinence as a worldwide problem.J. Int J Obset Gynecol, 2003,82: 327-338
2. MANSI PARIKH,MARY RASMUSSEN, LINDA BRUBAKER et al.Three Dimensional Virtual Reality Model of the Normal Female Pelvic FloorJ Annals of Biomedical Engineering,2004,32(2).292-296

<i>Specify source of funding or grant</i>	fujian young people object
<i>Is this a clinical trial?</i>	Yes
<i>Is this study registered in a public clinical trials registry?</i>	No
<i>What were the subjects in the study?</i>	HUMAN
<i>Was this study approved by an ethics committee?</i>	Yes
<i>Specify Name of Ethics Committee</i>	the review board of the Health Sciences Center of Fujian Medical University
<i>Was the Declaration of Helsinki followed?</i>	Yes
<i>Was informed consent obtained from the patients?</i>	Yes