ORIGINAL RESEARCH—PEYRONIE'S DISEASE

A Geometric Model of Plaque Incision and Graft for Peyronie's Disease with Geometric Analyses of Different Techniques

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ABSTRACT

Introduction. A surgical approach with plaque incision and graft (PIG) to correct Peyronie's disease is the best method for complex, large deviations. However, the geometric and mechanical consequences of this intervention are poorly understood.
Aim. The aim of this study was to analyze the geometric and mechanical consequences of PIG on penile straighten surgery.
Method. A tridimensional penile simile model with a curvature of 85° was created to test all of the most common PIG techniques. PIG with double-Y, H-shape, and Egydio techniques were used to rectify the curved penile model.
Main Outcome Measurements. The results that differed from a rectified cylinder shape were highlighted.
Results. All of the analyzed techniques created a geometric distortion that could be linked to poor surgical results. We suggest a new technique to resolve these abnormalities.
Conclusion. Current techniques designed to correct penile deviation using PIG present geometric and mechanical imperfections with potential consequences to the postoperative success rate. The new technique proposed in this report could be a possible solution to solve the geometric distortion caused by PIG. **Miranda AF and Sampaio FJB. A geometric model of plaque incision and graft for Peyronie's disease with geometric analyses of different techniques. J Sex Med 2014;11:1546–1553.**

Key Words. Peyronie's Disease; Erectile Dysfunction; Plaque Incision and Grafting Surgery for Penile Curvature; Graft; Corporoplasty; Geometric

Introduction

The first successful surgical treatment of penile curvature to achieve excellent results with low morbidity was performed by Reed M. Nesbit in 1964 [1]. In his original article, the author commented that the deformity was created by an asymmetry between the two sides of the corpora cavernosa (one being long and the other short). The treatment should therefore either lengthen the short side or shorten the long side. The latter option was adopted by the author and remains one of the current treatment options. In 1983, Benson and Patterson reported the use of Nesbit's technique for Peyronie's disease [2].

In 1947, Lowsley and Gentile reported the first use of a graft to correct this penile deviation, lengthening the short side. The authors performed a plaque excision in the affected side (short side) and inserted fat tissue as a graft [3]. In 1974, Devine and Horton reported a modification of the graft tissue using skin instead of fat [4] and obtained a better result and an acceptable outcome.

In 1991, Gelbard and Hayden [5] reported the use of an artificial erection to measure the disparity between the longer and shorter penile sides. The authors used multiple transversal incisions to open the corpora cavernosa. To straighten the penis, the cumulative length of the gaping of all incisions

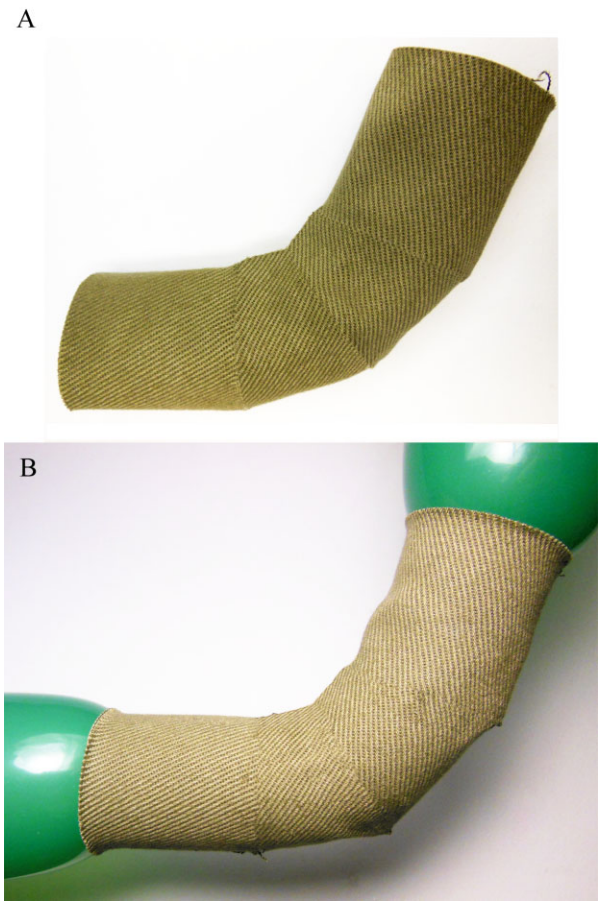

Figure 1 Penile model with 85° deviation. The outer layer was made using knitted cotton fabric and a cylindrical balloon is inflated inside. (A) Cotton outer layer without the balloon. (B) Cotton outer layer with the balloon inflated inside.

during longitudinal traction must be equal to this disparity. These gapes were closed with a temporalis fascia graft. This was the first report involving graft size calculation to correct penile deviation and the use of plaque incision and grafting (PIG) instead of excision and grafting. In 1995, the same author, in another elegant study, reported the use of a double-Y incision to avoid the diameter reduction caused by linear incision [6].

In 1998, Lue and El-Sakka [7] modified the double-Y incision, widening the bifurcation angle to 180° to transform the double-Y shape into an H-shape.

In 2002, Egydio et al. [8] used the graft size calculation and the double-Y incision as the basis of a new geometric surgical approach.

Currently, grafts are the preferred method for correcting penile deviation because of their advantages over plication techniques. Grafts can correct large deviations (>60°), multiplanar curvatures, and hourglass defects while avoiding reductions in penile length [9]. However, our knowledge of the geometric and mechanical alterations to the corpora cavernosa caused by PIG is limited.

In the present study, the occurrence of geometric and mechanical alterations caused by PIG during Peyronie's disease correction was investigated.

Materials and Methods

During full erection, the corpora cavernosa are similar to a cylinder with an outer layer formed by stretched tissue (the tunica albuginea being distended close to their limit during an erection) and an inner compartment containing a high-pressure liquid (blood). Based on these characteristics, we constructed a three-dimensional cylinder model, using knitted cotton fabric as the tunica albuginea (outer layer) (Figure 1A) and an inflated, cylinder-shaped balloon on the inside (pressure of 120 mm Hg) (Figure 1B). The cylinder model was constructed with a deviation of 85° to analyze the geometric and mechanical modifications of the penile structure following PIG using the most common techniques (double-Y, H-shape, and Egydio). We took photos of the model at various angles and created illustrations over them using computer software Inkscape version 0.48 (Software Freedom Conservancy, Brooklyn, NY, USA) (Figure 2).

Results

Double-Y/Egydio—Dorsal or Ventral Deviation

After a double-Y incision and penile straightening, we closed the defect with a simulated graft (Figure 3). As a result, excess tissue can be observed on the wound edges (visualized as three gray triangles on each side of the wound (Figure 3). This excess of tissue does not allow the graft to fit perfectly into the defect. If we calculate the graft size using the Egydio technique, the result is a graft that is smaller than the defect (transverse length), caused by a graft site with a larger caliber than the normal penile diameter (caused by the gray triangles; Figure 3). The graft is calculated for a normal caliber. Additionally, this calculation results in a hypercorrection of the deviation, resulting in a new penile band at the opposite side of the curvature (Figure 3D). Two indentations on the opposite side of the graft are also visible.