CURRENT THERAPY
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Vaginal Reconstruction

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Reconstruction of a vaginal defect is a difficult challenge, not only because of the complex anatomy involved but also because of the significant emotional, psychological, and sexual implications. In addition to the standard reconstructive goals of obtaining a closed wound, obliterating dead space, and providing healthy vascularized tissue, the surgeon must create a sensate, functional vagina that is capable of sexual intercourse while externally resembling normal female genitalia. These goals require a team approach, including a plastic surgeon, gynecologist, psychiatrist, and sex therapist.

Congenital Vaginal Agenesis

Reconstruction of a congenitally absent vagina requires the creation of a stable, lined space between the bladder and rectum. Split-thickness skin grafts have been used by surgeons as far back as the late 19th century. To minimize the inevitable contracture of the split grafts, Sadove and Horton have described the use of full-thickness skin grafts. Skin grafting procedures should be delayed until the patient has the motivation to comply with a postoperative stenting and dilation regimen. These procedures should be performed at as young an age as possible to allow normal psychosexual development.

The authors' preferred technique is that of full-thickness skin grafts (Fig. 1). First, a space must be created between the bladder and rectum. Full-thickness skin grafts should be harvested bilaterally either from the lateral (hairless) groin crease or from a lower abdominal crease. The skin grafts should be sutured together over a stent. Many stents can be used for supporting vaginal skin grafts, including condoms stuffed with foam, cotton or gauze sponges over Xeroform, or even commercially available adjustable vaginal stents. An inferiorly based, inverted "V" incision is made in the introitus. The "V" flap is sutured inside the newly created space, followed by insertion of the stent covered with the skin grafts sutured together. The outer edges of the graft are sutured to the "V" flap and the remaining opening of the introitus. A suprapubic tube is recommended to avoid erosion into the urethra as a result of pressure from the stent.

After 5 days, the first stent change is performed under anesthesia. Subsequent dressing changes can be performed without anesthesia. A regimen of daily stent changes, sitz baths, and douching is prescribed for approximately another 3 to 4 weeks. After the first month, a nighttime dilator is used to maintain the space for an additional 2 to 3 months.

Although graft contraction is certainly diminished by using full-thickness grafts, there is still some contraction of the neovagina over time if the space is not maintained by either a dilator or frequent intercourse. In patients not compliant with a dilation regimen, the introitus can contract significantly and make it difficult to introduce a small dilator. For these patients, we have designed a custom-made dilator with a tissue expander. It can be introduced even through a very small opening, followed by gradual inflation of the expander with saline injections. If necessary, labial sutures can be placed to hold the expander in place.

Acquired Vaginal Defects

The vast majority of acquired vaginal defects requiring reconstruction result from surgical resection for malignancy. The defect created is often large, and many of the patients receive postoperative radiation treatment; therefore, flaps are generally recommended over skin grafts. Cordeiro and colleagues
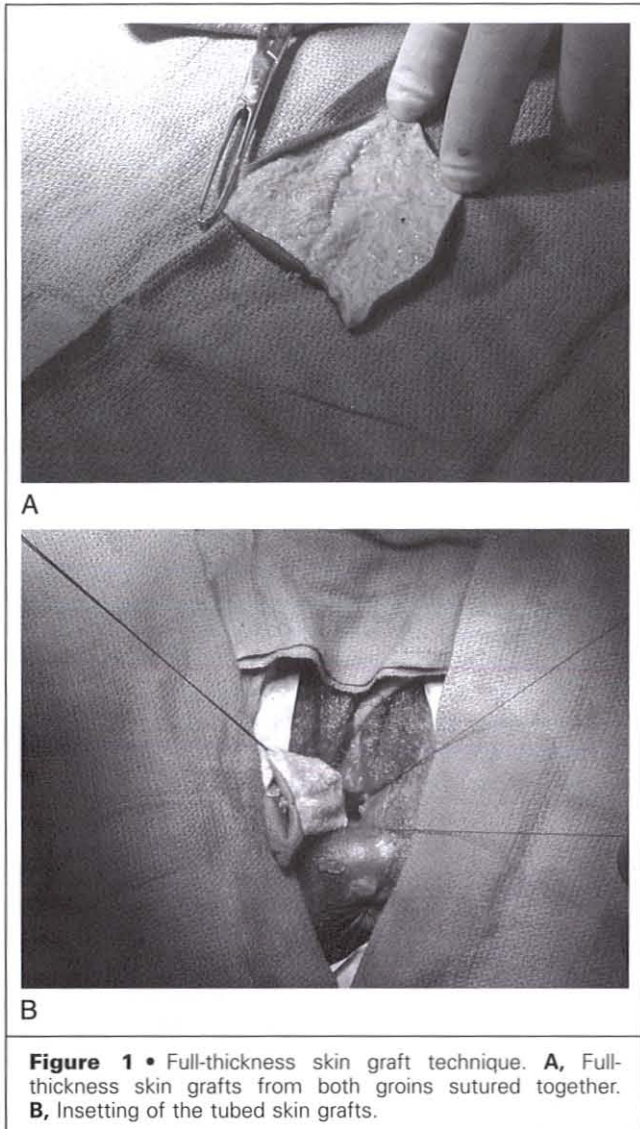
Figure 1 • Full-thickness skin graft technique. **A,** Full-thickness skin grafts from both groins sutured together. **B,** Insetting of the tubed skin grafts.

created a classification system for vaginal defects and generated an algorithm to assist in the selection of an appropriate flap. In general, for small or partial vaginal defects, a fasciocutaneous flap based on the pudendal artery (*Singapore flap*) is recommended, whereas for larger defects, often associated with pelvic exenteration, a myocutaneous flap (either the *rectus abdominis* or *bilateral gracilis*) is preferred.

Singapore Flap

The Singapore flap, first described by Wee and Joseph and later modified by Woods and coworkers, is a fasciocutaneous flap based on the posterior labial arteries. The flap can remain at least partially sensate based on innervation from pudendal nerve branches, as well as branches of the posterior cutaneous nerve of the thigh.

This posteriorly based flap is centered over the medial thigh crease just lateral to the labia majora (Fig. 2). The flap measures 15 × 6 cm with the long
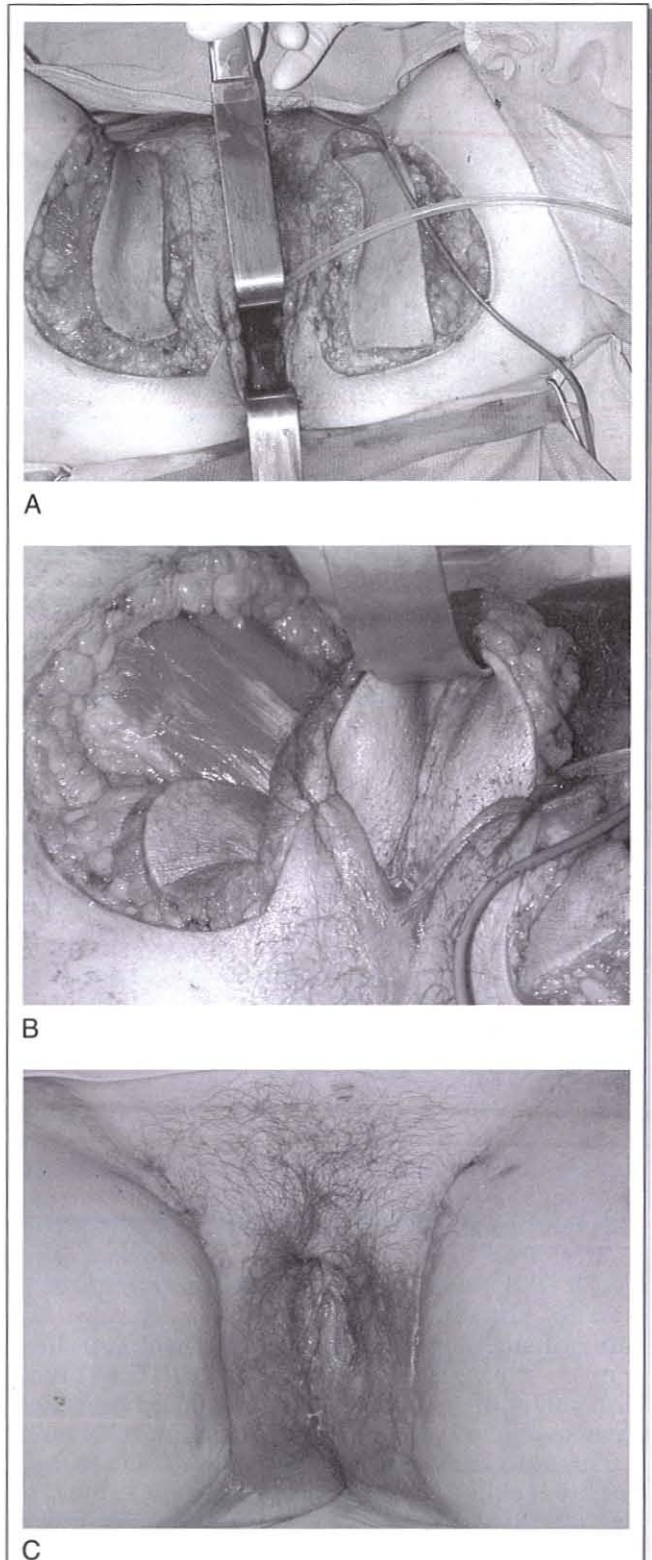

Figure 2 • Singapore flap. **A,** Bilateral island flaps centered over the medial thigh crease. **B,** Insetting of the flaps. **C,** Postoperative view of the donor site scars.
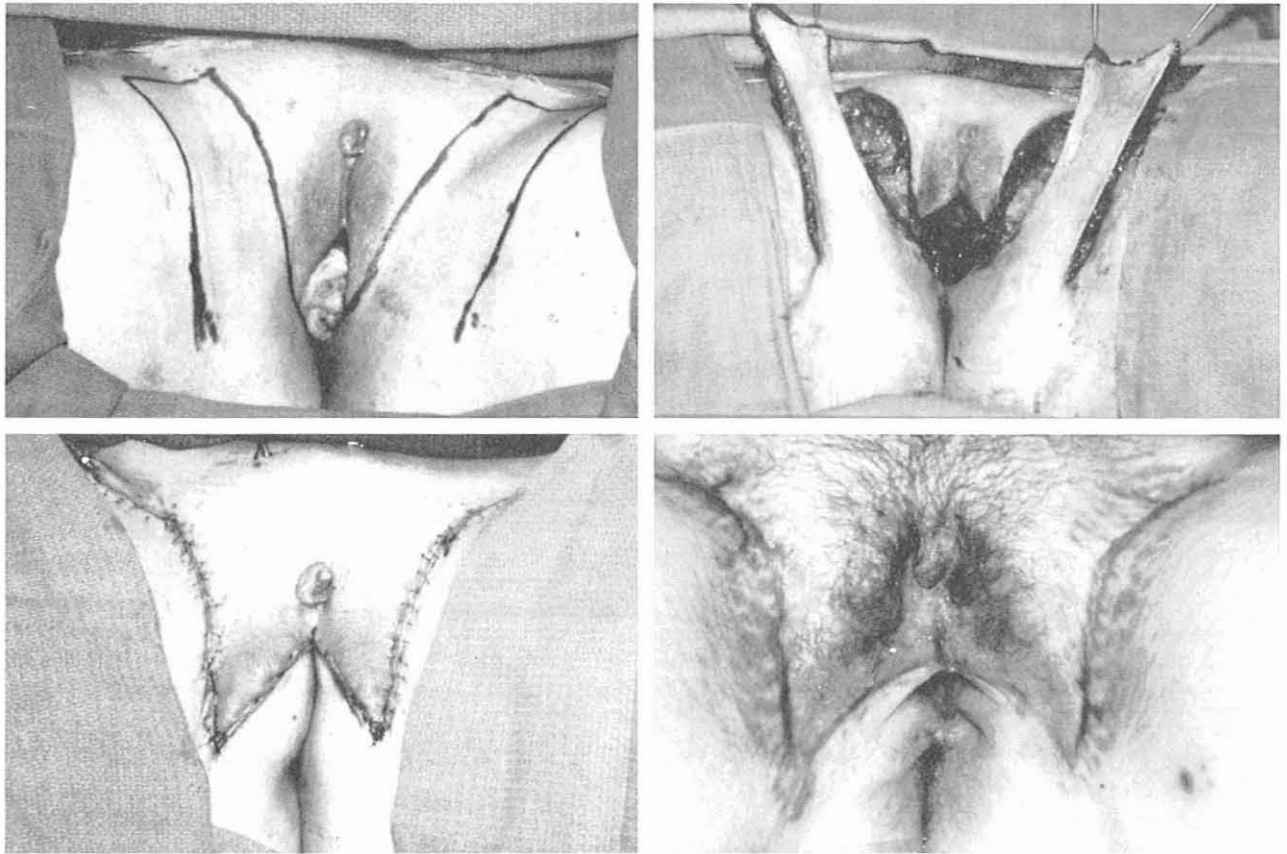
Figure 3 • The Woods modification of the Singapore flap. Note that the inferior edge of the flap is not divided. Instead, the labia are released and allowed to retract anteriorly. (From Woods JE, Alter G, Meland B, Podratz K: Experience with vaginal reconstruction utilizing the modified Singapore flap. Plast Reconstr Surg 90:273, 1992.)

axis parallel to the medial thigh crease. The flaps are elevated in an anterior-to-posterior direction and include the deep fascia of the thigh adductors. The medial, lateral, and anterior incisions are extended through the skin, subcutaneous layers, and deep fascia of the thigh adductors. A posterior incision is extended through skin and subcutaneous tissue to create an island flap. The island flap is rotated approximately 90 degrees and passed through a tunnel deep to the labia majora. In Woods and colleagues' modification, however, the posterior margin of the labia majora is released; there is no posterior skin incision (Fig. 3). The labia are allowed to retract anteriorly and the flaps are rotated into position. In both techniques, the flaps are sutured together and inserted into the defect, with the apex of the flaps sutured to the sacrum (in total exenteration defects) or to any other pelvic structure. The patient is kept in bed postoperatively with the thighs adducted for at least 2 to 3 weeks.

The island flap technique (Wee and Joseph) has the advantage of better-positioned scars and thus more normal-appearing labia. There is a slight risk of flap loss because of the potential for external pressure at the base of the flaps from the tunneling. The
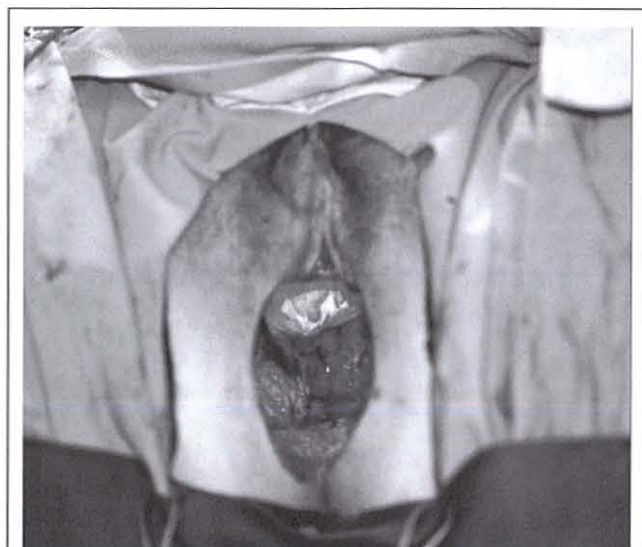
Woods modification allows for a more reliable flap, but with a somewhat distorted appearance of the labia. The authors generally prefer the island flap technique; however, the Woods modification should be considered in patients who are at an increased risk for wound complications.

The main advantages of the Singapore flap are that it provides sensation to at least the anterior portion of the flaps and does not require an abdominal incision. The major disadvantage is that it does not provide a large amount of bulk and may therefore not be appropriate for pelvic exenteration patients.

Rectus Abdominis Myocutaneous Flap

For large pelvic exenteration defects, the first choice for reconstruction is the rectus abdominis myocutaneous flap. Based on the inferior epigastric artery, it is extremely reliable and can also provide a large amount of bulk with minimal donor site morbidity (Fig. 4).

A vertically oriented elliptical skin island is designed over the proximal half of the muscle starting approximately 5 cm below the costal margin and extending to a position 3 cm below the umbilicus. The skin island should be 10 to 12 cm wide. The

Figure 4 • Rectus abdominis myocutaneous flap. **A,** The pelvic defect after tumor resection. **B,** The flap tubed to form the neovagina.

remainder of the rectus abdominis can be exposed through a midline incision or paramedian incision. The entire anterior rectus fascia should be taken with the muscle at the level of the skin island, but distally the muscle should be elevated through an incision in the midline of the rectus sheath to spare the fascia. It is usually unnecessary to disengage the muscle from its pubic attachment because such attachment can be helpful in avoiding undue tension on the vascular pedicle.

The anterior rectus donor fascia defect can occasionally be closed primarily in patients with relaxed abdominal walls. Alternatively, the cephalic edge of the anterior rectus fascia, which has been closed primarily caudal to the skin island, can be sutured to the posterior rectus fascia because the skin island is cephalad to the linea semicircularis. This technique allows primary fascial closure, which can be reinforced by an onlay polypropylene mesh. The skin can be closed primarily with undermining.

The skin island is tubed to form the neovagina by suturing the medial, lateral, and caudal skin edges together and leaving the cephalic edge open to be sutured to the remaining perineal skin. The flap can be transposed into position by either tunneling under the skin or connecting the abdominal incision to the pelvic incision. Multiple closed suction drains should be placed in both the donor site and the recipient site to obliterate dead space and prevent seromas. The patient is kept in bed postoperatively (with the thighs adducted) for at least 2 to 3 weeks.

Although the rectus abdominis myocutaneous flap is very reliable and can provide a large amount of healthy tissue for the wound, it has the obvious disadvantages of being insensate and requiring abdominal incisions.
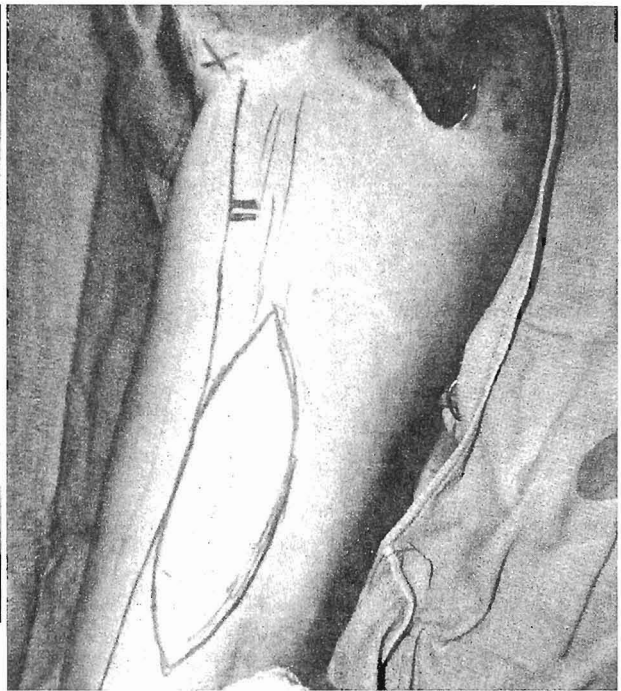
Gracilis Myocutaneous Flap

Because use of the rectus abdominis is not always feasible, an alternative reconstructive option is that of bilateral gracilis myocutaneous flaps based on the ascending branch of the medial circumflex femoral artery, a branch of the profunda femoris (Fig. 5). The flap has the disadvantage of having a somewhat unreliable skin paddle, particularly in overweight or elderly patients with loose and redundant medial thigh skin. Nevertheless, it is still a reasonable option for vaginal reconstruction in patients in whom more bulk is required than can be provided by a fasciocutaneous flap or in whom the rectus is unavailable. Furthermore, this flap should be strongly considered in patients who have had their ablative surgery performed through a perineal incision only because eliminating abdominal incisions decreases the risk for pulmonary complications.

The gracilis is palpated (from the pubis to the medial tibial tubercle) and marked with the patient standing upright to be certain that the skin island is centered over the muscle. The patient is placed in the lithotomy position, and the vascular pedicle is
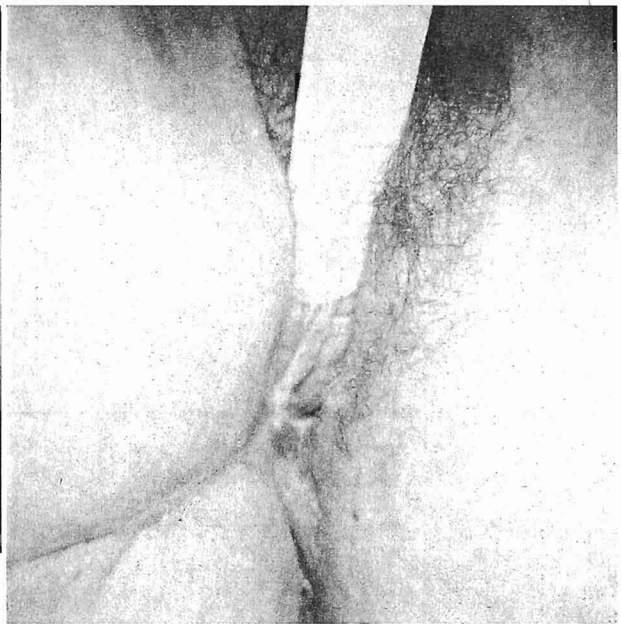
Figure 5 • Unilateral gracilis myocutaneous flaps **A,** Preoperative view showing a partial vaginal defect. A Singapore flap was not possible because of extension of the defect onto the medial aspect of the thigh. **B,** Markings for the gracilis myocutaneous flap. "X" marks the pubic tubercle and the double lines mark the vascular pedicle. **C,** The flap being rotated into position. **D,** Postoperative view showing a healed wound and patent neovagina.

identified by Doppler and marked on the skin. The pedicle usually enters the muscle 8 to 10 cm below the pubic tubercle. The skin island, which can be used only over the proximal two thirds of the muscle, measures approximately 6 × 15 cm. The muscle is elevated distally to proximally. Several minor vascular pedicles originating from the superficial femoral artery must be divided. The distal incision is made, and the muscle is identified and divided. The skin island is incised down to the deep fascia of the thigh, and the fascia is elevated until the edge of the gracilis is visualized. The dermis should be sutured to the fascia edge temporarily during elevation to avoid unintentional undermining of the flap. The muscle should be elevated to the level of the dominant vascular pedicle. It is generally not necessary to release the origin of the muscle for insetting of the flap.

The flaps are tunneled beneath the skin of the medial thigh crease and sutured to one another, with the most anterior edge left open. The flaps are inset into the defect. The open edge of the skin island is sutured to the remaining perineal skin. Postoperative care is similar to that for the rectus abdominis flap.

Advantages of this flap include a sufficient amount of bulk for most exenteration defects and avoidance of abdominal incisions. Disadvantages include large medial thigh scars, an insensate flap, and relatively unreliable skin islands.

Pearls and Pitfalls

- Most cases of congenital vaginal agenesis can be managed by full-thickness skin grafts, provided that the patient is able to comply with the prolonged process of dilation and stenting.
- In the case of acquired defects, which are most often a result of tumor ablation, the defect is generally too large for a skin graft, and a flap is required.
- For smaller defects, the Singapore flap is the best option because of its ability to maintain partial sensibility.

- Patients with pelvic malignancy require soft tissue bulk that is best provided by insensate myocutaneous flaps. The rectus flap has a much more reliable skin island and is generally the first choice.
- Many postexenteration patients already have an abdominal incision. In patients without an abdominal incision, the gracilis myocutaneous flap is a satisfactory option.
- With the gracilis flap, the surgeon must keep in mind the large medial thigh scars, as well as the relative unreliability of the attached skin islands.
- It should be noted that the use of bowel to reconstruct the vagina, either as a sigmoid loop or as a free jejunal segment, has been described and should be kept in mind as an alternative method. Bowel is not the preferred choice of the authors because of patient complaints about excessive mucus formation and odor. In addition, it does not provide adequate bulk for large defects.

SUGGESTED READINGS

Abbe R: A new method of creating a vagina in cases of congenital absence. Med Rec NYU 54:836, 1898.

Concannon MJ, Croll GH, Puckett CL: An intraoperative stent for McIndoe vaginal construction. Plast Reconstr Surg 91:367, 1993.

Cordeiro PG, Pusic AL, Disa JJ: A classification system and reconstructive algorithm for acquired vaginal defects. Plast Reconstr Surg 110:1058, 2002.

Emiroglu M, Gulton SM, Adanali G, et al: Vaginal reconstruction with free jejunal flap. Ann Plast Surg 36:316, 1996.

McIndoe A: The treatment of congenital absence and obliterative conditions of the vagina. Br J Plast Surg 2:254, 1950.

Pratt JH, Smith GR: Vaginal reconstruction with a sigmoid loop. Am J Obstet Gynecol 96:31, 1966.

Sadove RC, Horton CE: Utilizing full thickness skin grafts for vaginal reconstruction. Clin Plast Surg 15:443, 1988.

Tobin GR, Day TG: Vaginal and pelvic reconstruction with distally based rectus abdominis myocutaneous flaps. Plast Reconstr Surg 81:62, 1988.

Wee JTK, Joseph VT: A new technique of vaginal reconstruction using neurovascular pudendal-thigh flaps: A preliminary report. Plast Reconstr Surg 83:701, 1989.

Woods JE, Alter G, Meland B, Podratz K: Experience with vaginal reconstruction utilizing the modified Singapore flap. Plast Reconstr Surg 90:270, 1992.