

The Modified McIndoe Technique: A Scar-free Surgical Approach for Vaginoplasty With an Autologous Micromucosa Graft



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OBJECTIVE	To evaluate the effect of a scar-free surgical approach, the modified McIndoe technique, in cases of vaginal agenesis.
MATERIALS AND METHODS	Seven patients with Mayer-Rokitansky-Kuster-Hauser syndrome underwent vaginoplasty with the modified McIndoe technique. Mucosa grafts harvested from the vulva were minced into small particles and transplanted to the neovagina.
RESULTS	Epithelization in the neovagina is approximately 20 times in size than that in the mucosa harvested from the donor site. An adequate vaginal length was obtained in all cases, with a minimal change in genital appearance and invisible scars. All 4 sex-active patients reported satisfactory sexual experiences, with spontaneous lubrication during intercourse.
CONCLUSION	With the modified McIndoe technique, using an autologous micromucosa graft harvested from the vulva and the buccal cavity, we can physiologically reconstruct a new mucosa-lined vagina with minimal sacrifice. UROLOGY 131: 240–244, 2019. © 2019 Elsevier Inc.

Mayer-Rokitansky-Kuster-Hauser (MRKH) syndrome is a rare disorder in women that presents as Mullerian agenesis, and it has an incidence between the range of 1/4000 and 1/5000.¹ Due to normal ovarian function, the secondary sexual characteristics are usually normal. Most of the patients have primary amenorrhea and absence of the upper two-thirds of the vagina, but normal appearance of the external genitalia and pubic hair growth. Other syndromes may also lead to congenital vaginal agenesis, such as androgen insensitivity syndrome, Turner syndrome, and Morris syndrome.

The creation of a neovagina can be accomplished by non-surgical or surgical techniques. A breakthrough procedure for vaginoplasty surgery was the Abbè-McIndoe technique, which uses a split-thickness skin graft to cover the neovaginal canal.^{2,3} Several variations have been proposed, which search for the ideal material adopted for the neovaginal canal lining.⁴⁻⁸ Multiple materials can be used, including

skin, peritoneum, bowel segments, amnion membranes, inert materials (oxidized regenerated cellulose and artificial dermis), autologous buccal mucosa, and in vitro vaginal cell cultures. No consensus has been reached on the ideal material. Possible problems related to these methods may be permanent scars, rejection, infectious disease, a long-term period to achieve a functional vagina, and the high requirement of surgical teams or tissue culture laboratories.⁹ This study discusses a new modified McIndoe technique that was applied in 7 patients with MRKH syndrome. A mucosa patch was harvested from the vulva or the oral cavity to cover the neovaginal canal, and satisfactory anatomic and functional outcomes were achieved with invisible scars at the donor site.

PATIENTS

From January 2016 to July 2016, we performed the modified McIndoe technique to create a neovagina in 7 patients with MRKH syndrome. All of the patients were diagnosed by gynecologists. Before the surgeries, the patients were counseled regarding alternative techniques and complications of the method. Informed consent was obtained from all 7 patients. Approval was obtained from the Institute Review Board. Clinical characteristics, perioperative data, mucosal lining, length and stenosis of the neovagina, the satisfaction with sexual experience were assessed.

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Conflict of Interest: All authors claimed that there is no conflict of interest.

Financial Disclosures: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Submitted: March 5, 2019, accepted (with revisions): May 16, 2019

SURGERY

The modified McIndoe technique was performed in the lithotomy position, under general anesthesia. The procedure included 4 steps (Fig. 1). In the first step, a mucosal patch was harvested from the vulva, with an area of 2 cm² in both sides, which meant a minimal total of 4 cm². In rare cases in which an adequate amount of mucosa cannot be obtained from the vulva, mucosa from the buccal cavity can be used as an adjunct to vulvar mucosa. In the second step, 200 ml of tumescent fluid was injected into the area between the urethral outlet and anus. Addition of several drops of epinephrine to the fluid helped in hemostasis. Then a new vaginal cavity was created between the bladder and rectum. Care was taken not to enter the peritoneal cavity or to cause injury to the adjacent organs. The third step was to mince the vulva and the adjunct buccal mucosa both into particles, with an approximate size of 1 mm³. The particles were immersed in saline, and then manually adhered to a gauze mold. Finally, the mucosal particles were grafted into the neovaginal cavity with a mold. The mold was stabilized to the labia majora and kept in situ for 7 days after the operation. During the first 3 days, the patients were required to stay in bed and were strictly immobilized. On the seventh day postoperation, the gauze mold was changed to a glass mold. Two different sizes of

mold 8 cm and 10 cm in length were selected. The smaller size was applied first. The mold was changed to a larger sized mold when the degree of vaginal relaxation allowed for the mold and the patient experienced minimal tension. Patients were instructed to wear the mold for the whole day during the first 3 months. Application of an estrogen-based vaginal cream daily helped to promote the growth of the vaginal mucosa. The frequency of utilization was reduced after the fourth-month postoperation. Depending on the individual patient, they can choose to take off the mold from 1 hour in the beginning, and then prolong it to 4-6 hours or even 12 hours. The time periods were not to be extended any further if the mold could not be easily inserted after taking it off. Patients were asked to use the mold until commencement of regular sexual activity.

RESULTS

The operation was performed successfully in all 7 patients. Four of the patients were sexually active. The mean age of patients was 23 years (range, 19-26 years) old. The mean operative time was 60 minutes, and the mean blood loss was 20 ml. The average follow-up period was 12 months (range, 6-24 months). Postoperative recovery was uneventful, with no complaint of infection, bleeding, fistula formation, or organ damage by the patients. Complete mucosal lining was achieved in all 7 female patients

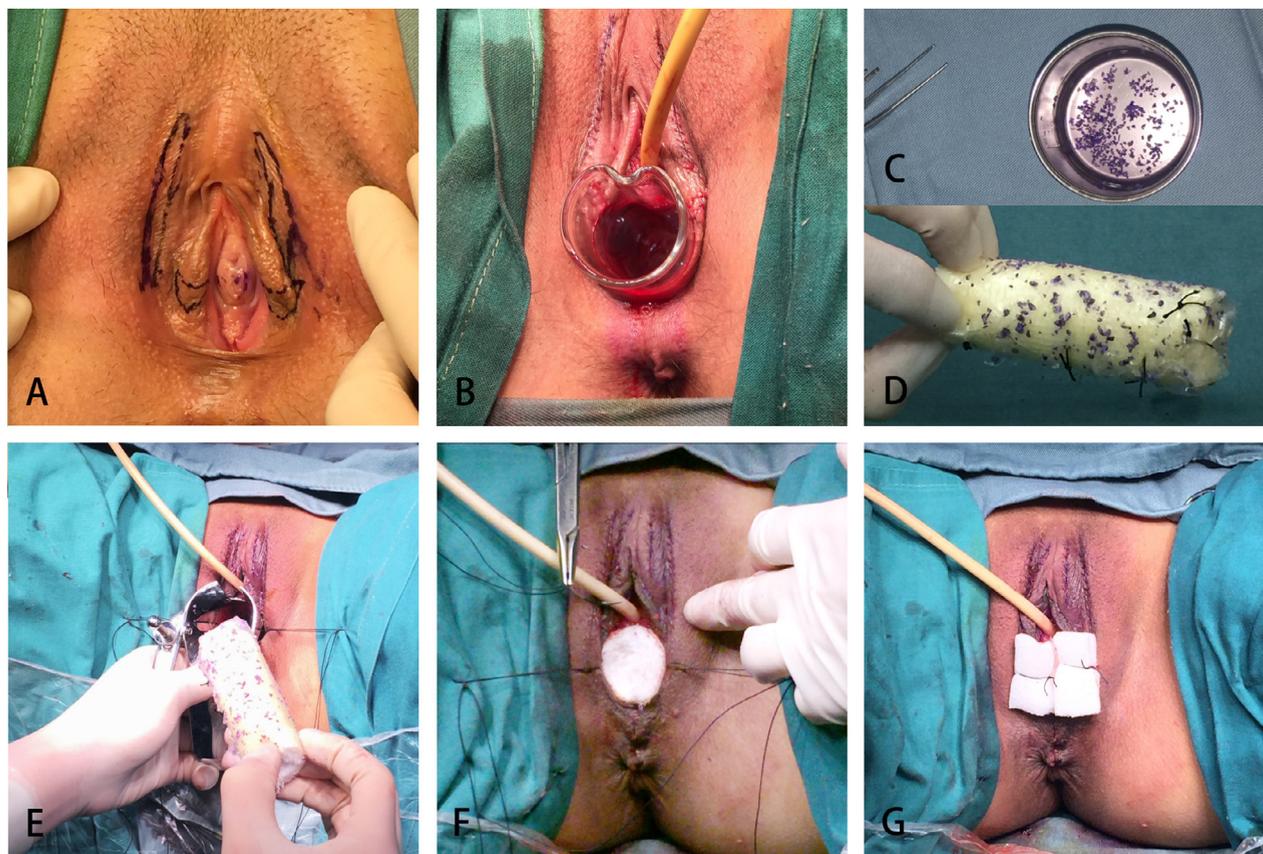


Figure 1. The procedure of the modified McIndoe technique. (A) A mucosal patch is harvested from the vulva. (B) A new vaginal cavity is created. (C) A mucosa patch is minced into particles. (D) Mucosal particles adhered to a gauze mold. (E) Graft mucosal particles with the mold. (F) The gauze mold is stabilized to the labia majora. (G) Final view. (Color version available online.)

within 1 month (Fig. 2). The neovagina was covered with pink-colored smooth mucosal lining at 3 months postoperation. Epithelization in the neovagina was approximately 20 times in size than that in the mucosa harvested from the donor site. In 5 patients, only the vulvar mucosa was used, while in 2 patients, adjunct buccal grafting was needed. Mean vaginal length after surgery was significantly longer as compared with the vaginal length before surgery (8.8 cm vs 0.4 cm). The appearances of the external genital before and after the operation are compared in Figure 3, and there was minimal change in the appearance and invisible scars. Little discomfort in the oral cavity or influence on the masticatory function was reported by patients in whom an oral graft was used as a supplement. All 4 sexually active patients reported satisfactory sexual experiences, with the achievement of an adequate length and width of the neovagina. Spontaneous lubrication facilitating sexual intercourse was reported by 2 patients.

DISCUSSION

Vaginoplasty is an important surgical procedure to improve physical and psychological well-being of women with congenital vaginal agenesis. According to the American College of Obstetrician and Gynecologists, the progressive dilatation technique, described by Frank, should be attempted first before surgical intervention.¹⁰ Although satisfactory vaginal length and sexual function can be achieved,¹¹ the feelings of embarrassment and shame, which develop during the rather long period of dilator use, cannot not be ignored.¹² Surgery is a second-line treatment, which is usually reserved for patients who have failed the conservative approach or are non-compliant.¹⁰ The best surgical treatment of vaginal agenesis is still under discussion. Ideally, the reconstruction should be able to provide sufficient dimension, physiological mucosa lining, and satisfactory sexual function, while causing minimal donor site morbidity. Several methods have been suggested, including Abbè-McIndoe



Figure 2. Mucosa lining at 3 months postoperation. (Color version available online.)

technique,³ Vecchietti's operation,¹³ Davydov's technique,⁴ Williams's technique,¹⁴ and Creatsas modification.¹⁵ Among these surgical methods, the Abbè-McIndoe technique is the most widely adopted. The procedure does not require an abdominal incision, which may lead to increased complications, but the skin graft harvested from the buttocks, thigh, or the lower abdomen is needed. A poor esthetic result at the donor site is one of the most annoying problems of the traditional McIndoe method. Especially in Asian patients, a permanent conspicuous scar may be left behind. Besides significant scarring, major disadvantages of skin grafting or intestinal substitution include prolonged recovery time, need for prolonged immobilization for growth of the skin graft, and lack of lubricant during sexual intercourse for the skin graft. In 2003, Lin et al presented a new idea that suggested lining the canal with buccal mucosa.¹⁶ Due to the limited size of mucosa in the buccal cavity, Yesim Ozqenel et al came up with an idea that dividing the graft into smaller pieces 2-4 cm² can provide the same replacement.¹⁷ But some authors reported prolonged donor site discomfort¹⁸ or limited jaw opening.

Our surgical practice incorporates the ideas of these 2 techniques. In vaginal cosmetic surgeries, tissues from surrounding areas such as the labia minora, labia majora, or clitoris are used to perform the repair. We hypothesized that these mucosae or skins can also be applied in vaginoplasty surgeries. But the next question was that the amount of tissue is far from adequate as compared to the traditional skin graft. Inspired by the Recell system, in which the cellular spreading rate is as high as 1:80. Tissue from the vulva or the buccal cavity is cut into particles as small as possible, and then they are immersed in saline. This suspension helps to increase the cellular spreading rate to approximately 1:20.

Our technique can overcome some of the disadvantages of the traditional McIndoe technique. First, patients with vaginal agenesis may be ashamed of visible scarring, and therefore, masking of the donor site is of special importance. In our practice, mucosal pieces are obtained from a natural fold or abundant skin tissue of the vulva, which avoids the deformation of the donor site. Usually, a graft measuring 6 cm² in total can be harvested from the vulvar area, which is quite adequate for transplantation. In rare cases in which an adequate amount of tissue cannot be obtained from the vulva, tissue from the buccal cavity can act as a supplement to vulvar tissue. Compared to the classical autologous buccal mucosa graft, harvesting oral mucosa as less as 1.5 cm² causes less discomfort and has less influence on the masticatory function (Fig. 4). Finally, the mucosal lining is obtained, which constitutes a physiological vaginal reconstruction, and spontaneous mucus production was reported by the patients. These merits may make this modified technique a better choice for vaginal reconstruction. However, an apparent demerit of our practice is that a vaginal stent needs to be used for a long time period until the commencement of the active sex life. We assumed that it would be a major issue for these

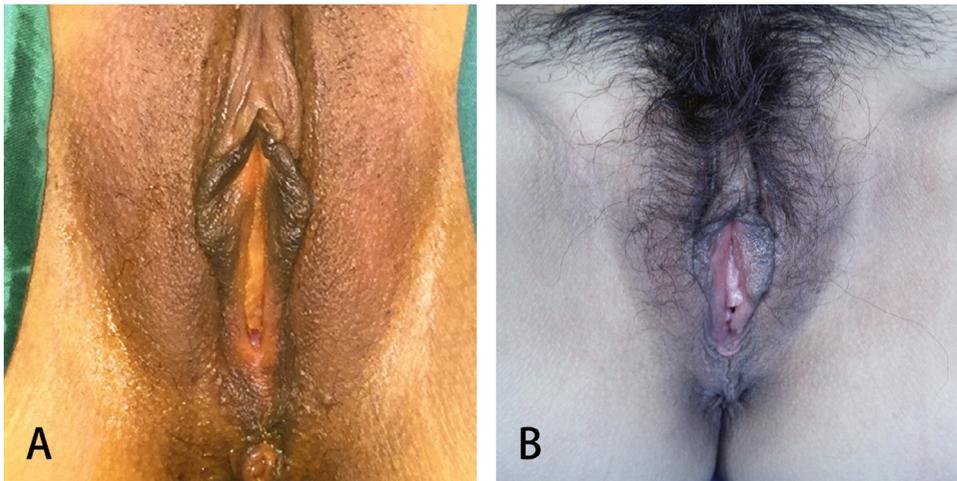


Figure 3. Comparison of the external genitalia before and after the surgery. Before (A) and after (B). (Color version available online.)



Figure 4. Harvesting of 1.5 cm² mucosa from the buccal cavity, which acts as a supplementary donor site. (Color version available online.)

young female patients, but none of them reported that wearing the molds for a long time period was a daily nuisance.

There are also several points that need to be discussed. First, the cellular spreading rate of 1:20 is just an attempt based on our experience. Further experiments are needed to determine if we can achieve the same effect of mucosal growth by harvesting less tissue from the donor site. Both the particle sizes and buffer systems should be improved. Second, we do not have the pathologic result of the neovagina. Tissue for transplantation is obtained from the junction between the mucosa and the epidermis, which indicates that the lining of the neovagina may comprise a single type or both types of cells. However, the clinical outcome is satisfactory as none of the patients complained of dryness during intercourse. More precisely, the biopsy of the neovagina should be performed to confirm the growth of the mucosa. Third, we just performed simple follow-ups, which included checking the growth of the mucosa and inquiry about the complaints of patients, instead of systematic estimation based on the Female Sexual Function Index questionnaire. In

further research, scientific scales should be applied, and a longer follow-up is also needed.

In conclusion, with use of an autologous micromucosa graft harvested from the vulva and the buccal cavity, we can physiologically reconstruct a new vagina with mucosal lining, and it leads to minimal donor site morbidity and an almost invisible scar.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.urology.2019.05.020>.

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