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Editorial

The First Oral Mucosal Graft Urethroplasty Was Carried Out in the 19th Century: The Pioneering Experience of Kirill Sapezhko (1857–1928)

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Among the techniques successfully used for primary urethral augmentation, oral mucosal graft urethroplasty has gained popularity over the last decade. In modern publications, Graham Humby (1909–1970), from London, is credited with being the first surgeon to describe an oral mucosal graft to augment a strictured urethra in 1941 [1,2]. Our review has revealed that this technique was first described at the end of the 19th century by the Russian surgeon Kirill Sapezhko (1857–1928) (Fig. 1) [3]. He published his experience of four cases of urethral stricture disease treated in men using oral mucosal grafts in the Russian medical journal *Chirurgicheskaya letopis* [4] and provided original drawings and pictures of his patients.

1. Biography

Kirill Sapezhko was born in the Chernigov region of Ukraine in 1857. He started his medical career in 1884 as a general practitioner after graduating from St. Vladimir Kiev Imperial University, Ukraine, which was at that time a part of the Russian Empire. After 2 yr, Sapezhko returned to the university to continue his medical education as a resident in the ophthalmologic clinic. In 1888 he joined the Department of Surgery of the university and worked as a prosector of operative surgery, studying topographic anatomy and pathology. Simultaneously, he also worked as chief in the surgical clinic at the Kiev Kirillov medical hospital, where he worked with a wide spectrum of complicated cases in peasants [5].

From 1886 onward, Sapezhko was an active member of the Kiev Doctors Society and repeatedly presented case reports and new methods of surgical treatment. His first recorded presentation was devoted to successful eyelid entropion treatment using oral mucosa according to the method initially described by Millingen [6,7]. In 1900, Sapezhko suggested a new method of umbilical hernioplasty [8]. In 1902, after returning to Russia, he was elected professor of surgery in the Odessa clinic of Novorossiysk Imperial University. Sapezhko became an internationally recognized specialist. From 1905 to 1914, he took part in the German Congresses of Surgeons and in the Congress of Surgeons, Radiologists and Orthopedists in Berlin. He also participated in the Fourth International Congress of Surgeons in New York. He joined the Red Cross mission during World War I, published guidelines for gunshot wound treatment, and posted papers on military surgery and sanitation for injured men [9,10].

2. Clinical findings

While working in Kiev in the late 1880s, Sapezhko began experimental work using animal studies [11] to evaluate the properties of mucosa and investigate its use as a graft. Later, in his PhD thesis, "Clinical Material to the Topic of Mucosa Transposition" [12], he described five sequential periods relating to changes in the surface of transplanted oral mucosa:

1. The first, "deathly pale," period lasts $\leq$12 h; if it continues >1 d, there is little chance that the mucosa will adhere. (This period is now known as *imbibitions*,

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Fig. 1 – Professor Kirill Mikhailovich Sapezhko, Odessa. Photo by B. Gothlieb, 1902.

with graft survival dependent on the permeation of nutrients from the graft bed.)

2. The next period, "cyanotic coloration," usually begins 6 h after transplantation. This period is characterized by the appearance of cyanotic sites on different areas of the graft, which progressively extend. After 12–24 h, the whole graft becomes intensively cyanotic and edematous. These changes are the first and certain auspicious signs of blood flow initiation. (This period is now known as *inosculation.*) If this period lasts longer, the graft becomes at high risk of consequent shrinkage and atrophy because of insufficient blood supply.
3. After 48 h, when the graft becomes pink, the third period, "mucosa dimness," starts. In 2 d, the mucosa gets covered by a filmlike dim deposit. A thin and transparent deposit layer with pink mucosa underneath is a good prognostic sign, while a thick, pale deposit at the surface is the result of a poor graft supply and points to a high graft atrophy risk.
4. The fourth period—the period of "graft cleansing"—begins when the dim deposit desquamates and the transplanted mucosa becomes visible. Usually this period takes place on the fourth day and lasts for several days.
5. The last period, "complete engraftment," starts the 10th day after the operation.

The experienced plastic or reconstructive surgeon can easily identify in this seminal work an elegant, early description that encapsulates all the features of successful grafts that underpin our modern practice: preventing hematoma formation under the graft at an early stage of grafting to facilitate the graft's "taking" and subsequent graft management relating to the 4–5-d period of graft immobilization with dressings and subsequent wound management. As a result of his experimental observations, Sapezhko postulated several statements: (1) Human mucosa adheres much better than that of animals; (2) mucosal grafts require careful management during the procedure; and (3) the oral mucous membrane is a useful material for tissue substitution in ophthalmologic and urethral surgery.

3. Urethroplasty case reports

Sapezhko performed successful urethroplasty using oral mucosa as far back as 1890. He described the case of a 40-yr-old patient with an idiopathic urethral stricture that had been slowly progressing over 10 yr (Fig. 2). The patient had used self-catheterization for some time, but then the stricture narrowed and was not passable. After a period of urinary retention, an abscess formed in the scrotum, resulting in a urethral fistula. Examination with bougies showed that they were "stopped by obliteration at the scrotal part." During the first stage of the subsequent two-stage surgical approach, a scrotal incision was made from the posterior part of the penile urethra up to the fistula. The scrotum was dissected in two symmetrical parts, with preservation of the integrity of the testicles and their covering layers. Sapezhko found that the urethra was completely replaced by scar tissue for 7–8 cm of its length. A lower lip (labial and, presumably, buccal) oral mucosal graft 7–8 × 2 cm wide was harvested from the patient. The graft was fixed to the proximal and distal ends of the urethra and to the underlying tissues at the edges. The wound was kept open and not sutured, and catheterization was performed through the proximal urethrostomy and fistula. The mucosa was irrigated with iodoform and covered with foil. Nineteen

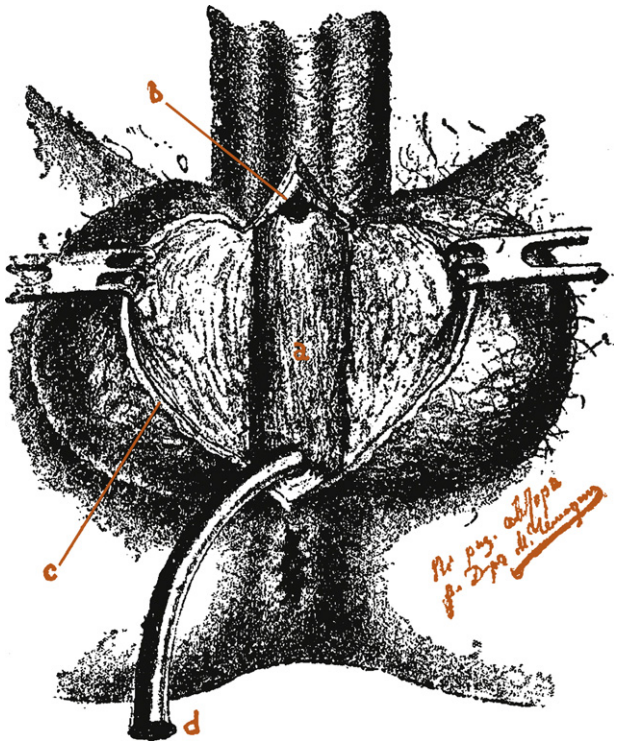

Fig. 2 – First case: (a) underlying tissues, (b) distal end of urethra, (c) split scrotum, (d) catheter.

days later, the wound was closed over the catheter with silk sutures in the second stage of the surgery. Sapezhko wrote that silk was inadequate material, because the suture was rejected, with small abscess formation in 2 wk. When the catheter was removed, the patient regained his ability to urinate. He was followed up closely for 4 mo and then again 2 yr after the operation; the patient was satisfied with micturition and sexual function.

In this procedure, Sapezhko described not only the use of oral mucosa but also the two-stage urethroplasty approach being popularized by contemporaries in Europe and now known as the Thiersch-Duplay approach. In 1869, Thiersch described a technique using local tissue flaps to repair epispadias [13]. In 1880, Duplay used a similar type of periurethral skin flap to form a neourethra in patients with hypospadias [14].

The second case of oral mucosal surgery dates back to 1891 and describes the cure of a 42-yr-old military officer who had undergone treatment of a preputial ulcer with several attempts at "hot ironing" and curettage over an 18-mo period. When the ulcer finally was closed, the penile skin and urethra were obliterated by scar tissue, the urethra was not visible on the glans to the scrotum, and a new meatus had opened on the scrotum. Sapezhko operated on the patient in one stage by removing the scar tissue, using tubularized mucosal graft harvested from the upper lip and buccal cavity to create a neourethra. The surgery was finished by covering the penile shaft with a spiral-formed scrotum skin flap and perineal urethrostomy. After 16 d, the bandage was removed and the urethra was found passable. Normal voiding with a strong stream was restored and remained satisfactory at 1 yr of follow-up. After 2 yr, the patient died from lung disease. Sapezhko performed an autopsy and found that the grafted mucosa looked healthy and elastic. This case demonstrates the effective use of a tubularized graft, which in contemporary practice is contraindicated and in most cases best replaced by a two-stage procedure because of the high failure rate. Sapezhko, however, demonstrated the importance of soft tissue cover of a urethral reconstruction and the usefulness of a flap of scrotal skin.

In 1893, Sapezhko performed a urethroplasty for a 13-yr-old boy with a posttraumatic urethral stricture after having fallen from a tree and sustaining an injury astride a branch. At first the patient developed a big hematoma; urinary retention was followed by a septic inflammation of the perineum and the left half of the abdomen, with an infected urinary fistula in the right groin, through which he urinated. On examination there was free passage of the thinnest dilator for 6–7 cm proximal to the meatus. The operation performed was a one-stage procedure. After widely opening the fistula tract, Sapezhko found a defect 4 cm in length with a completely absent urethra in the bulbar urethra adjacent to the pubic symphysis. A lower lip and buccal mucosal graft, 3–4 cm in size, was taken and placed to fill the urethral defect. The bladder was catheterized, the urethra was covered by foil, and the wound was partly sutured and plugged by tampons. In 2 mo, the wound had almost healed but did not close completely because of a small fistula. The fistula was considered to be due to the silk sutures left in the wound and led to a revision procedure performed after 2 mo. During the revision, Sapezhko found that the neourethra was in satisfactory shape; it was wide enough to let the surgeon's finger pass through, and Sapezhko removed several silk sutures that remained in situ. The wound closure was successful, but one of the sutures became untied and resulted in a remaining small fistula. The patient was not operated on again but coped by closing the fistula with his index finger during micturition.

Sapezhko described the last of his four pioneering cases as a complete failure. According to his account, he was fascinated by the previous results and tried to use a big oral mucosal graft in a 62-yr-old man with a postinflammatory perineal urethral fistula and broad perineal scar formation complicated by a hydrocele with a volume of 1 l. During the surgery, Sapezhko performed hydrocelectomy, scar removal, and fixation of the harvested buccal mucosal graft. However, the hydrocele removal caused significant shrinkage of the surrounding tissues, which damaged the blood supply and led to graft atrophy.

Sapezhko's promising method of urethroplasty was used and further developed by his apprentice I.A. Thyrmos, a surgeon from Odessa. In a 1902 article, Thyrmos described a successful case of buccal mucosal urethroplasty and a case of rectum mucosa application for urethral substitution [15].

4. Conclusion

At the end of the 19th century, Kirill Sapezhko was the first to describe and publish cases of successful urethroplasty using oral mucosa. His technique was then lost until rediscovered by Graham Humby >50 yr later. Sapezhko also clearly described and understood many of the principles of modern grafting that are now routine in reconstructive surgery. Clearly, Sapezhko should be recognized and acknowledged as a pioneer of oral mucosal urethroplasty.

Conflicts of interest: The authors have nothing to disclose.

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