

# *The utility of buccal mucosa graft in salvage urethroplasty*

G. Weinberg, MD,<sup>1</sup> P. E. Williot, MD,<sup>2</sup> M. P. Leonard, MD<sup>1</sup>

<sup>1</sup>Division of Urology, Children's Hospital of Eastern Ontario, University of Ottawa, Ottawa, Ontario, Canada

<sup>2</sup>Division of Urology, Montefiore Medical Center, Albert Einstein University, Bronx, New York, USA

---

WEINBERG G, WILLIOT PE, LEONARD MP. The utility of buccal mucosa graft in salvage urethroplasty. *The Canadian Journal of Urology*. 2002;9(5):1641-1645.

**Objective:** To evaluate our results with buccal mucosa free grafts in salvage urethroplasty.

**Patients and methods:** Retrospective chart review of autologous buccal mucosa grafts for urethral reconstruction at Winnipeg Children's Hospital and Children's Hospital of Eastern Ontario between November 1992 and March 2000.

**Results:** Nine patients (median age 4 years) underwent such reconstruction. Seven of the nine patients had experienced failed previous attempts at hypospadias

repair. Onlay grafts were used in all but one patient who required a tube graft. Urethrocuteaneous fistula was the most common post-operative complication, affecting four of nine patients. Two patients developed urethral strictures and one a meatal stenosis. Satisfactory functional results were ultimately achieved in all patients. Harvest site complications were minimal.

**Conclusions:** Buccal mucosa is a readily available and useful source for urethral grafting material, but should only be used in patients with insufficient penile skin. Grafts may be used as onlays or tubes. It is our experience that despite precautionary measures, fistulae and strictures are common.

**Key Words:** hypospadias, buccal mucosa, free grafts, urethroplasty, fistula

---

## Introduction

The difficulties of hypospadias repair are compounded when local penile skin is unavailable for urethral reconstruction. This lack of skin usually stems from previous unsuccessful attempts at

hypospadias repair or trauma. The need for an alternative to penile skin for urethral reconstruction has motivated urologists to investigate a variety of graft materials. Urologic pioneers in the early part of the past century experimented with the appendix, ureter and even the saphenous vein as possible graft materials.<sup>1</sup> More recent efforts have centered around bladder mucosa, processus vaginalis, and full thickness skin from relatively hairless sites such as the upper inner arm and iliac crest.<sup>2</sup> Of late however, a consensus has been forming around the utility of buccal mucosa as a reliable source for urethral

---

Accepted for publication August 2002

Address correspondence to Dr. Garry Weinberg, Urology Resident, University of Ottawa, 307-60 McLeod Street, Ottawa, Ontario K2P 2G1 Canada

grafting.<sup>1,2</sup> Our experience with autologous buccal mucosa grafts for urethral reconstruction in nine patients is detailed herein.

## Materials and methods

### Patients

A retrospective chart review of patients undergoing buccal mucosa free graft urethroplasty from November 1992 to March 2000 was carried out. Information gathered included patient age, diagnosis, number of previous penile surgeries, type and length of buccal mucosal graft, length of hospital stay, and outcome as regards complications.

### Procedure

Peri-operatively each patient received a prophylactic dose of intravenous ampicillin and gentamicin. Post – operatively they were started on a prophylactic dose of trimethoprim/sulfamethoxazole until removal of the urethral catheter/stent. In all cases

an Otorhyno-Laryngologist harvested the buccal mucosa graft from the inner aspect of the patient's cheek, in order to minimize any potential injury to Stenson's duct. The harvest site was closed primarily with absorbable sutures. Each graft was subsequently defatted by the attending surgeon, and trimmed to the appropriate dimensions. The graft was then used as an onlay over the urethral plate (8/9 cases) or interposed between two normal segments of urethra as a tube graft after it had been tubularized around a catheter (1/9 cases). In this latter case the mid-urethra had been burned by electrocautery at the time of circumcision and a thick split thickness skin graft had been used to cover the skin defect in a prior procedure. All buccal mucosa grafts were anastomosed to the urethra using running 6-0 Vicryl®. The grafts were then covered with a well-vascularised flap of dartos fascia or tunica vaginalis as a precautionary measure intended to increase the blood supply to the graft and consequently decrease the risk of urethral fistulae. Patients were admitted

TABLE 1. Patient characteristics

Pt. No.	Age (yrs)	Indication: Prior surgery	Days in hospital	Follow-up (mos)	Location	Type of repair	Graft length x width
1	11	<b>perineal urethrostomy:</b> urethral strictures following skin graft of penile shaft for cautery injury	12	40	proximal penile	tube	20 mm x 18 mm
2	3	<b>peno-scrotal hypospadias:</b> failed initial Duckett repair	10	22	peno-scrotal	onlay	20 mm x 10 mm
3	3	<b>persistent peno-scrotal fistula:</b> failed 2 <sup>nd</sup> stage hypospadias repair	11	58	peno-scrotal	onlay	30 mm x 10 mm
4	3	<b>coronal fistula post-circumcision:</b> two prior attempts at repair	10	18	coronal	onlay	12 mm x 12 mm
5	10	<b>multiple urethral strictures:</b> failed 2 <sup>nd</sup> stage hypospadias repair	6	3	distal penile	onlay	40 mm x 10 mm
6	4	<b>coronal fistula:</b> failed 2 <sup>nd</sup> stage hypospadias repair of chordee/hypoplastic urethra	5	12	coronal	onlay	20 mm x 10 mm
7	1	<b>perineal hypospadias:</b> 1 <sup>st</sup> stage correction of peno-scrotal transposition with chordee release	33	2	perineal	composite	20 mm x 15 mm
8	49	<b>peno-scrotal fistula:</b> failed previous hypospadias repair	13	11	peno-scrotal	composite	60 mm x 10 mm-15 mm
9	5	<b>midshaft hypospadias:</b> failed three previous hypospadias repairs	13	12	mid-shaft	onlay	25 mm 10 mm

to hospital and kept on strict bed rest for 5 days to prevent shearing of the graft such that it could establish an adequate blood supply. Oral intake was resumed as tolerated. Urethral stents or silastic Foley catheters were utilized in all cases and were removed at 10 days post-operatively. At 6 months post-operatively all toilet trained patients (4/9) were objectively assessed by uroflowmetry and post-void residual estimate using a Bard BVI 2500 ultrasonic bladder scanner. Long term follow-up is planned for all patients.

## Results

A total of nine patients underwent autologous buccal mucosa grafts for urethral reconstruction; eight at Winnipeg Children's Hospital/Health Sciences Centre and one at the Children's Hospital of Eastern Ontario. Except for one man aged 49, all of our patients were children ranging from 1 to 11 years of age with a median age of 4 years and average age of 5 years.

Neo-urethral coverage	complications
dartos flap	urethral strictures at proximal and distal graft edges
tunica vaginalis	urethral diverticulum in neo-urethra
dartos flap	peno-scrotal fistula; meatal stenosis
dartos flap	coronal fistula
tunica vaginalis	none
tunica vaginalis	coronal fistula
tunica vaginalis	stricture with peno-scrotal meatus
dartos flap	scrotal fistula
dartos flap	none

Seven of the nine patients in this series had undergone previous unsuccessful attempts at hypospadias repair each having had 1-3 prior attempts at repair with an average of 1.4 prior repairs each. The buccal mucosa free grafts were used as onlays in all but one patient, who required a tube graft to replace his distal urethra which had been traumatized by a cautery burn at the time of circumcision.

Grafts ranged from 12 mm to 60 mm in length, and in one patient, a composite onlay graft (two buccal mucosa grafts sutured in series) was required. All patients were comfortable on oral fluids within 24 hours, and were free of dietary restrictions within 48 hours. On average patients were discharged home 9 days after surgery; the length of stay ranging from 5 to 13 days with a median hospitalization of 10 days. For detailed patient characteristics please see Table 1.

In terms of early complications, fistula formation emerged as the primary cause for re-operation. Four patients underwent fistula repair on average 7 months after the initial buccal mucosa free graft, the earliest at 5 months post-operatively and the latest at 12 months post-operatively. Three patients with post-operative fistulae were repaired in a standard fashion involving re-approximation of the fistula and coverage with subcutaneous tissue and a two layer skin closure without interposing a flap. Follow-up to date has demonstrated ongoing success in two of these patients, the third patient having developed a further fistula recurrence. He and his parents have opted to pursue no further urologic interventions at the present time. Our fourth patient had a meatotomy to remove a tissue bar between a coronal fistula and his neomeatus thus preserving a functional stream and allowing the potential for a future glans-plasty.

Other early complications included one case each of meatal stenosis and a diverticulum of the buccal mucosa graft; the latter preceded by the sole occurrence of a UTI. One patient suffered a limited cellulitic infection of his harvest site that responded promptly to vancomycin therapy. Neither scar contractures nor other functional or aesthetic complications arose from the donor site. In terms of other potential complications, we noted that the graft did not lead to the development of chordee with contractures.

Urethral strictures emerged as the most notable long term complication in our series, emphasizing that the length of follow up remains a critical determinant of the results of this and similar studies. Two of nine patients have thus far developed urethral strictures. One patient remained problem free for over 36 months until a decrease in urinary stream was noted. His

stricture was treated by direct visual internal urethrotomy (DVIU) followed by a strict regimen of intermittent catheterisation to prevent subsequent stricture development. A similar treatment regimen was provided for our second patient to develop a stricture.

Only two patients have remained free of complications to this point in time. Both patients had onlay graft procedures after failing previous hypospadias repairs; one for repair of multiple strictures and the other for a mid-shaft hypospadias. Currently all of our toilet-trained patients have normal urinary flow demonstrated by uroflowmetry, are able to void when standing and have a non-spraying single urinary stream.

## Discussion

Patients who have undergone previous unsuccessful attempts at hypospadias repair usually leave the urologist with little choice but to seek sources of extra-penile materials for urethral reconstruction. At present, buccal mucosa stands out as one of the most promising materials of choice. Buccal mucosa is readily accessible and, as Burgher et al note, the intra-oral harvest site ensures an excellent cosmetic result at the donor site and provides a constant and adequate source of non-hair bearing graftable material.<sup>2</sup>

In contrast, accessing bladder mucosa, the next most common extra-penile graft source, requires a suprapubic incision with a corresponding increase in morbidity.<sup>3</sup> Buccal mucosa also benefits from a decreased tendency to shrink when compared to bladder mucosa which needs to be harvested 25% to 35% larger than its final caliber. Furthermore a neo-meatus molded from bladder mucosa lends itself to functional and aesthetic complications, namely an exfoliative prolapse causing stenosis and splaying of the stream as well as a sticky metaplastic meatus that develops mucin secreting glands.<sup>4</sup> This complication is commonly referred to as a "cauliflower" deformity.<sup>3,5</sup>

Buccal mucosa grafts share several of the positive characteristics associated with free skin grafts while demonstrating specific advantages over free skin grafts. Both graft materials are readily available, accessible and offer the potential of one stage corrections with reasonable cosmetic results.<sup>1</sup> However buccal mucosa provides a distinct advantage over free skin grafts in that it is thicker and tougher, allowing it to accept sutures more easily with less shredding, shrinkage and stricture.<sup>6</sup> Buccal mucosa also heals better than free skin grafts, exhibits decreased keloid formation at the donor site and maintains superior distensibility compared to skin.<sup>2,7</sup>

Advantages other than ease of harvest contribute to buccal mucosa's increasing popularity as a graft source. On a macroscopic level buccal mucosa offers the urologist increased ease of handling while its wet epidermal surface is specifically adapted to the moist environment in which the graft must function.<sup>7</sup> Although buccal mucosa grafts in conditions devoid of constant moisture have had less success due to scaling, they have successfully been used by Venn et al in urethral reconstruction for balanitis xerotica obliterans.<sup>5,8</sup> On a microscopic level buccal mucosal lamina propria is much thinner and the epithelium much thicker than either skin or bladder mucosa with an extensive vascular network running throughout. These qualities stand the buccal mucosa graft in good stead for its immediate tasks of imbibition and inosculation, while a predominance of elastic fibres contribute to the aforementioned ease of handling. In addition the relatively low rate of infection seen in ours and other reported series may stem in part from lingual antibacterial peptide (LAP); a peptide recently discovered in bovine buccal mucosa which appears to enhance the healing of buccal mucosa harvest sites.<sup>5</sup>

Despite the many advantages of buccal mucosa grafts, complications following salvage urethroplasty continue to occur, in particular fistula formation. Morey et al note a success rate higher than the norm for their series of hypospadias repair and attribute their success with buccal mucosa grafts to their exclusive use of adult patients.<sup>6</sup> They postulate that the distal hypospadiac urethra of the child has much less spongiosum than the adult bulbar urethra and that this lack of spongiosum subsequently interferes with imbibition and inosculation. Local scarring from prior reconstructive operations has also been postulated as a potential cause of compromised graft viability.<sup>9</sup> Given that all our patients had scarring present as a result of prior attempts at repair and that all but one patient was in the pediatric population, our higher rate of fistulae formation than generally reported may not be all that surprising.

Our perception that fistulae are more common in all free graft urethroplasties involving relatively scarred recipient beds garners support from other studies of complicated free graft urethroplasties which employed either skin or bladder mucosa grafts on both children and adults. In terms of bladder mucosa grafts for such repairs, Duffy et al reported a 26% fistula rate over a relatively short mean follow-up period of 6.6 months with 21 of 23 patients having failed previous hypospadias repairs.<sup>10</sup> Similarly, Redman's report of his experience with free skin grafts for hypospadias repair demonstrated a fistula rate of 30%.<sup>11</sup> When assessed in the context of free graft urethroplasties onto relatively

scarred recipient beds it appears that fistulae are more common in all free graft urethroplasties with the choice of graft material being somewhat immaterial.

Most authors agree that a well vascularised cover for the neo-urethra is helpful for free graft take and to decrease the risk of fistula formation. Controversy exists however as to how best to achieve this goal. Most studies advocate using a well vascularised three layered closure consisting of tunica vaginalis, subcutaneous fascia and skin. In contrast to this generally accepted view, Yerkes et al avoid using tunica vaginalis altogether, considering it to be a barrier to the process of imbibition and inosculation.<sup>12</sup> Our series of patients experienced no difference in the rate of complications arising from the use of tunica vaginalis versus Dartos flap urethral cover. The small size of our series does not allow us to critically assess whether there is a disadvantage to the use of tunica vaginalis for urethral cover. The series of 62 children operated on by Fichtner et al did use tunica vaginalis for coverage and three patients suffered loss of practically the entire graft while in the series of Yerkes no such complication occurred.<sup>12,13</sup>

In our study, four patients developed fistulae as a post-operative complication of the buccal mucosa graft with two of these four patients developing fistulae in the coronal region. It has been postulated that the cause of recurrent coronal fistulae may stem from the less than optimal blood supply that the corona provides for the graft. Yerkes et al attribute their increased rate of coronal cuff fistula formation to suboptimal coverage of the hypospadias repair in this area. They found that buccal mucosa grafts anastomosed to a proximal skin urethroplasty were more likely to experience fistula formation, in particular when the anastomosis was placed near the coronal collar.<sup>12</sup> In order to deal with this problem, Yerkes goes so far as to suggest that when first stage hypospadias repairs are undertaken, a redundancy of coronal skin should be left given that a buccal mucosa graft may be needed in the future.<sup>12</sup> One solution to the issue of coronal fistulae suggested by Fichtner et al may be to intentionally leave the neomeatus at the level of the corona rather than advancing it to a tip of the glans position.<sup>13</sup> They based this concept on studies that have demonstrated that the urethral meatus is in a proximal location on the glans in many adults. The authors believe that this results in a lower rate of meatal stenosis because the compressing effect of the closed glans wings on the neo-urethra is thus prevented. Avoiding a tip of the glans meatus and leaving a slightly shorter neo-urethra requiring less coverage may indeed make it possible to reduce subsequent complications such as coronal fistula. Interestingly, our one case that involved a tube graft did not develop a fistula and

remained free of complications for over 36 months until proximal and distal strictures were recently identified. One would have thought that such a patient would be more prone to the development of complications sooner than those patients who had undergone onlay procedures.<sup>14</sup>

## Conclusions

Buccal mucosa is a readily available and useful source for urethral grafting. This should not be a first line choice for urethral reconstruction, but rather should be utilized in patients with circumstances which limit the availability of penile skin. The grafts may be used as onlays or tubes, and a second layer of vascularized tissue should be laid over the repair to minimize complications. Despite these precautionary measures, fistulae are common, and will likely require secondary repair. Long term follow-up to survey such patients for the development of urethral strictures would be prudent. Although there are obvious limitations to the use of a free graft, buccal mucosa is a useful material for salvage urethroplasties. □

## References

1. Dessanti A, Rigamonti W, Merulla V, Falchetti D, Caccia G. Autologous buccal mucosa graft for hypospadias repair: an initial report. *J Urol* 1992;147:1081-1084.
2. Burgher RA, Muller SC, El-Damanhoury H, Tschakaloff A, Riedmiller H, Hohenfellner R. The buccal mucosal graft for urethral reconstruction: a preliminary report. *J Urol* 1992;147:662-664.
3. Duckett JW, Coplen D, Ewalt D, Baskin LS. Buccal mucosal urethral replacement. *J Urol* 1995;153:1660-1663.
4. Kinkead TM, Borzi PA, Duffy PG, Ransley PG. Long-term follow up of bladder mucosa graft for male urethral reconstruction. *J Urol* 1994;151:1056-1058.
5. Baskin LS, Duckett JW. Buccal mucosa grafts in hypospadias surgery. *Br J Urol* 1995;76(Suppl 3):23-30.
6. Morey AF, McAninch JW. Technique of harvesting buccal mucosa for urethral reconstruction. *J Urol* 1996;155:1696-1697.
7. El-Kasaby AW, Fath-Alla M, Noweir AM, El-Halaby MR, Zakaria W, El-Beialy MH. The use of buccal mucosa patch graft in the management of anterior urethral strictures. *J Urol* 1993;149:276-278.
8. Venn SR, Mundy AR. Urethroplasty for balanitis xerotica obliterans. *Br J Urol* 1998;81:735-737.
9. Morey AF, McAninch JW. When and how to use buccal mucosal grafts in adult bulbar urethroplasty. *Urology* 1996;48:194-198.
10. Duffy PG, Ransley PG, Malone PS, Van Oyen P. Combined free autologous bladder mucosa / skin tube for urethral reconstruction: an update. *Br J Urol* 1988;61:505-506.
11. Redman JF. Experience with 60 consecutive hypospadias repairs using the Horton-Devine techniques. *J Urol* 1983;129:115-118.
12. Yerkes EB, Adams MC, Miller DA, Brock III JW. Coronal Cuff: A problem site for buccal mucosa grafts. *J Urol* 1999;162:1442-1444.
13. Fichtner J, Fisch M, Filipas D, Thüroff, Hohenfellner R. Refinements in buccal mucosa graft urethroplasty for hypospadias repair. *World J Urol* 1998;16:192-194.
14. Venn SN, Mundy AR. Early experience with the use of buccal mucosa for substitution urethroplasty. *Br J Urol* 1998;81:738-740.