

# Reconstructive Urology

Authors from India describe their experience in a series of patients with bulbar urethral strictures in whom they used a buccal mucosal graft. They found this to be the most versatile substitute.

## Buccal mucosal urethroplasty: a versatile technique for all urethral segments

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### OBJECTIVE

To present our experience with buccal mucosa urethroplasty for substitution of all segments of the anterior urethra, as the buccal mucosal graft (BMG) has emerged as the tissue of choice for single-stage reconstruction of bulbar urethral strictures, but its use for reconstructing meatal, pendulous and pan-urethral strictures has not been widely reported.

### PATIENTS AND METHODS

Between January 1998 and October 2003, 92 patients had a BMG substitution urethroplasty at our institution; 75 had a single-stage dorsal onlay BMG urethroplasty (bulbar 41, pendulous 16 and pan-urethral 18; six combined penile skin flap and BMG) and 17 (pendulous five, pan-urethral 10, bulbar two) a two-stage urethroplasty. Recurrence rates, complications and cosmetic outcomes were analysed retrospectively.

### RESULTS

Over a median (range) follow-up of 34 (8–72) months, 66 (88%) patients with a one-stage reconstruction (14/16 pendulous; 37/41, 90%, bulbar; 15/16 pan-urethral) remained stricture-free. The mean (range) time to recurrence was 9.4 (3–17) months. Of the nine recurrent strictures, six were

managed by one-stage optical urethrotomy and three required a repeat urethroplasty. In patients who had a staged procedure, after a mean follow-up of 24.2 (9–56) months, one had complete graft loss, requiring re-grafting, five required stomal revision after stage 1, and only two (12%) developed a recurrent stricture after the two-stage urethroplasty.

### CONCLUSION

A one-stage dorsal onlay BMG urethroplasty provides excellent results for strictures involving any segment of the anterior urethra. The BMG appears to be the most versatile urethral substitute, as it can be successfully used for both one- and two-stage reconstruction of the entire anterior urethra.

### KEYWORDS

buccal mucosa, urethroplasty, free grafts, stricture urethra

### INTRODUCTION

Anterior urethral strictures, which are not amenable to end-to-end anastomosis, require substitution urethroplasty. This may be achieved by using penile skin flaps or free grafts of full-thickness skin, bladder or buccal mucosa (BMG). The BMG is fast emerging as the most versatile urethral substitute [1] as it

has ideal graft characteristics and can be harvested with no significant morbidity [2]. There is sufficient evidence to suggest that it is the tissue of choice for reconstructing bulbar urethral strictures [3,4]. It is also the preferred substitute for strictures related to balanitis xerotica obliterans (BXO), as the use of penile skin as a graft or flap is contraindicated in such cases [5-7]. In difficult situations BMGs can also be combined successfully with other urethral reconstructive techniques [8].

Despite its success in the bulbar segment, the use of BMG for one-stage reconstruction of meatal, pendulous and pan-urethral stricture disease has not been widely reported. Penile skin flaps have been preferred for reconstructing the fossa navicularis [9,10], pendulous [11,12] and pan-urethral strictures [13,14]. Although stricture recurrence rates have been similar with both graft and penile skin-flap urethroplasty [15,16], we [15] reported greater morbidity with the use of flaps and therefore prefer free BMG whenever possible. We herein present our results with one- and two-stage BMG urethroplasty for strictures involving all segments of the urethra.

#### PATIENTS AND METHODS

Between January 1998 and October 2003, 92 patients (mean age 37.2 years, range 11-64) with anterior urethral stricture disease had a substitution urethroplasty using free BMGs. The cause of stricture was inflammatory in 20, BXO in 39, traumatic in 13 and unknown in 20 patients. Fifty-two patients had a previous history of urethral dilatation or visual internal urethrotomy, whereas 12 had undergone previous urethroplasty. Investigations before urethroplasty included uroflowmetry, and a contrast study in the form of a retrograde urethrogram and voiding cystogram. The stricture site was bulbar in 43, pendulous in 21 and pan-urethral in 28; the mean (range) stricture length was 5.6 (3-17) cm. Seventeen patients had a two-stage urethroplasty and 75 a one-stage dorsal onlay urethroplasty (Table 1). The indications for a staged procedure included diffuse urethral inflammation, and a badly diseased urethra resulting in circumferential narrowing of <6 F. Buccal mucosa was harvested from one cheek in 54 patients (38 bulbar, 16 pendulous), both cheeks in 21 (five each bulbar and pendulous, 11 pan-urethral) and

Stricture site/ technique	N	Success, n (%)	Mean (range) follow-up, months
One-stage	75	68 (90)	36.2 (8-72)
bulbar	41	37 (90)	36.2 (8-72)
pendulous	16	14	
pan-urethral	12 (6)*	10	
Two-stage	17	15	24.2 (9-56)
bulbar	2	2	24.2 (9-56)
pendulous	5		
pan-urethral	10		

**TABLE 1**  
Stricture site, technique, success rate and follow-up of 92 patients undergoing BMG urethroplasty

\*Patients who had a combined dorsal onlay penile skin flap + BMG

both cheeks and lower lip in 17 (all pan-urethral). In six patients with pan-urethral strictures the available buccal mucosa was insufficient and a combined procedure was required (proximal BMG dorsal onlay and a distal penile skin flap dorsal onlay; Table 1). The study was retrospective for 1998, whereas from 1999 onwards all data were collected prospectively.

#### TECHNIQUE

A two-team approach was used; with the patient under general anaesthesia and nasotracheal intubation, the diseased urethra is exposed by incision, depending on the site of stricture. For pendulous urethral strictures a circumcoronal incision is used, whereas for more proximal strictures a midline perineal incision is used. The spongiosum is detached dorsally from the corpora and a urethrotomy is made exactly at the 12 o'clock position. In patients with associated meatal or fossa navicularis strictures, the stricturotomy is extended to the meatus. A dorsal meatotomy is then made and connected with the dorsal stricturotomy on the pendulous urethra.

Buccal mucosa is harvested from the cheeks or lower lip, depending upon the length of the stricture, and quilted to the corpora with interrupted 5-0 polyglactin sutures, and subsequently sutured to the cut edges of the urethra with continuous sutures. For meatal reconstruction, the distal most BMG is fixed with interrupted 5-0 polyglactin sutures to the dorsally cut margins of the meatus.

The two-stage procedure includes urethral opening, complete excision of the fibrotic tissue and BMG onlaying in the first stage. The urethra is reconstructed in the second stage, 4-6 months after the first.

The patient is discharged 3-5 days after surgery with an indwelling urethral and a suprapubic catheter. Catheters are removed 3 weeks later, after micturating cystourethrography. The follow-up was by clinical history, uroflowmetry and urethral calibration at 3-month intervals during the first year and subsequently every 6 months; contrast-medium studies were taken as and when required. Failure was defined as the recurrence of obstructive symptoms and/or failure to calibrate with a 16 F Foley catheter.

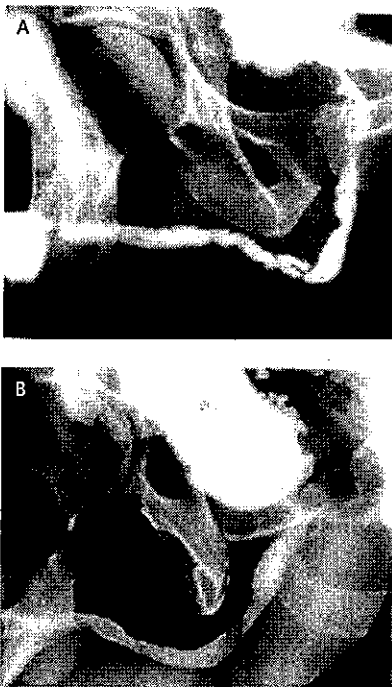
#### RESULTS

Five patients developed a fistula (three pan-urethral, one pendulous and one bulbar), all of which healed after extending the duration of catheterization by 7-10 days. The median (range) follow-up was 34 (8-72) months; 84 patients completed 1 year of follow-up and 12 have completed 5 years. The stricture recurred in nine patients but did not differ among the various segments of the urethra (four bulbar, three pan-urethral (Fig. 1a,b) and two pendulous (Table 1). The mean time to recurrence was 9 (3-17) months. Of these, six were managed by internal urethrotomy and three by repeat urethroplasty (one pan-urethral and one pendulous). In patients who had a two-stage urethroplasty, at a mean follow-up of 24.2 (9-56) months, there was total loss of the graft in two after the first stage. Both patients needed a repeat onlay with buccal mucosa. There was minimal loss of graft with no consequences in three other patients after a two-stage procedure. An adequate meatus could not be reconstructed in two patients during the second stage because of glans-cleft narrowing. Two patients developed recurrences in the bulbar segment, managed by internal urethrotomy, giving an overall success rate of 15/17 (Table 1).

We encountered no penile deformity or erectile dysfunction after urethral reconstruction in any patient. The incidence of troublesome postvoid dribbling and graft outpouching was also negligible.

One patient from whom three BMG strips had been harvested complained of mild oral dryness for 5 months. Two patients who had BMG harvested from both cheeks complained of mild pain and paraesthesia at the donor site which persisted for 3 and 8 months. There was no significant difference in morbidity

FIG. 1. A, A preoperative retrograde urethrogram of a patient with a pan-urethral stricture; B, a micturating cysto-urethrogram of the patient 6 months after a one-stage dorsal onlay urethroplasty with multiple BMG.



whether grafts were harvested from one or more sites. There was no cosmetic deformity or visible scar in any of our patients.

#### DISCUSSION

The present results show that in the presence of a viable urethral plate, a one-stage dorsal onlay BMG urethroplasty can be successful for reconstructing all segments of the anterior urethra. We reported our earlier experience [15] with substitution urethroplasty for complex anterior urethral strictures using penile skin flaps and BMG, wherein dorsal onlay BMG urethroplasty appeared to be the technique associated with the least complications. Encouraged by these results, we now prefer buccal mucosa for reconstructing all segments of the anterior urethra. Consequently, our use of penile skin flaps has steadily declined over the last few years and we resort to their use only for rare situations where the graft bed is severely compromised.

Dorsal onlay free-graft urethroplasty for bulbar urethral strictures has been reported to provide excellent outcomes in several studies [3,17]. Some [3,15] argue that dorsal onlay is superior to ventral onlay for bulbar urethroplasty, whereas others [5,18] have reported excellent long-term outcomes with ventral onlay techniques. We have previously described the potential advantages of dorsal onlay flap [19] and graft [15] urethroplasty for strictures involving the proximal bulb where the graft has to be extended into the membranous urethra. In this situation the dorsal flap or graft is technically easier to apply than a ventral onlay, which requires dissection of the vascular spongiosum. In the present study the medium-term success rate for bulbar urethroplasty was 90%, which agrees well with results from other centres (Table 2) [3,16,20,21].

Although widely used for bulbar urethroplasty, experience with BMG substitution for meatal, pendulous and pan-urethral strictures has been limited. Fossa navicularis and pendulous strictures have been conventionally reconstructed using ventral onlay penile skin flaps [9–12]. Wessels and McAninch [22] cautioned against the use of free grafts on the pendulous urethra, on the premise that the spongiosum is deficient in this segment and vascularity is too poor to support graft take. These concerns would be valid when applying the graft on the ventral aspect of the spongiosum. In dorsal onlay urethroplasty the graft take depends on the corpora cavernosa and only partly on the spongiosum. We had excellent results with dorsal onlay BMG urethroplasty for pendulous urethral strictures where the urethral plate was viable. We also extended this approach for those BXO-related strictures where the urethral plate has an adequate calibre (>6 F) to accept a graft. There was no chordee or sexual dysfunction in our series. Barbagli *et al.* [20] first reported the successful management of pendulous urethral strictures (range 1.5–4 cm) with dorsal onlay skin graft urethroplasty. Subsequently Grady *et al.* [23] reported an 87% success rate in treating 24 pendulous strictures with buccal mucosa urethroplasty. Asopa *et al.* [21] reported successful dorsal placement of BMGs on the pendulous urethra through a ventral sagittal approach. In support of this approach, Gupta *et al.* [24] recently described excellent short-term outcomes for combined bulbopenile and pan-urethral strictures.

A significant advantage of the present technique is that it allows for simultaneous reconstruction of associated meatal strictures. We previously described simultaneous meatal and proximal urethral reconstruction by the dorsally placed penile skin flap [19]. Using a similar technique the BMG is laid onto the dorsal aspect of the incised meatus and fossa navicularis, thereby avoiding any ventral glans dissection. The present study confirms that in properly selected cases, dorsal grafting of the pendulous urethra and meatus can provide outcomes comparable with those reported using other techniques. Moreover, the present technique involves minimal violation of the penile skin (cf. penile skin flaps) and results in an excellent cosmetic outcome.

TABLE 2 Reported outcomes after a one-stage dorsal onlay BMG urethroplasty

Ref	Stricture site	N patients	Site of BMG harvest	Mean follow-up, months	Success rate, n (%)
[3]	Bulbar	42	Cheek	48	37 (88)
[16]	Bulbar	23	Cheek	20	23 (100)
[21]	Pendulous	24	Cheek	26.6	21 (88)
[23]	Bulbopenile	8	Cheek +	12	11
	Pan-urethral	4	lower lip		

Pan-urethral strictures are usually inflammatory or BXO-related; a one-stage reconstruction of such strictures usually requires the use of lengthy penile skin flaps [13,14] or a combination of different urethral substitutes [25,26]. Wessels *et al.* [25] described their approach for long complex strictures where the predominant technique used was the fasciocutaneous flap. In seven patients with long anterior urethral strictures, penile skin flaps were used for distal reconstruction while grafts were used proximally. Berglund *et al.* [26] reported on 18 patients with a mean stricture length of 15.1 cm, reconstructed using the combination of a penile skin flap and BMG. We preferentially use several BMGs in managing such strictures and avoid the use of fasciocutaneous flaps, because of their inherent complications. This is particularly true for BXO-related strictures, where the use of penile skin is contraindicated. Using grafts from both cheeks and the lower lip, we have been able to reconstruct urethral lengths up to 17 cm. Only in situations where the available buccal mucosa is insufficient (six in the present series) to substitute the entire length of the stricture, do we combine its use with a dorsal onlay penile skin flap. In our experience, harvesting buccal mucosa from several sites does not lead to significant morbidity in the long term. This was supported by Jang *et al.* [2], who found no difference in morbidity when grafts were harvested from the cheek or lower lip. However, patients should be warned of mild numbness and parasthesia which can persist for a few months in rare cases.

Two-stage urethroplasty has been advocated for complex strictures such as those with a destroyed urethral plate and in the presence of BXO or active infection. We resort to two-stage procedures whenever the urethral plate is unsalvageable. Two of our patients had complete-graft loss after the first stage and required grafting. Stomal revision was required in four patients after stage 1. Andrich *et al.* [27] also reported many revisions after the first of a staged urethroplasty. Despite intervening procedures, the overall success rate in this group was 15 of 17.

In conclusion, BMG urethroplasty provides comparable medium-term results for reconstructing all segments of the urethra, and appears to be the most versatile tissue available for reconstruction, as it provides

excellent results for both one- and two-stage urethroplasty. The short- to medium-term results have been gratifying, although a longer follow-up will be needed before considering BMG as the best urethral substitute.

#### CONFLICT OF INTEREST

None declared.

#### REFERENCES

- Bhargava S, Chapple C. Buccal mucosal urethroplasty: is it the new gold standard? *BJU Int* 2004; 93: 1191–3
- Jang TL, Melendorp A, Gonzalez CM. Comparison of donor site intra-oral morbidity following buccal mucosal graft harvesting for urethral reconstruction. *J Urol* 2004; 171: 241A
- Andrich DE, Leach CJ, Mundy AR. The Barbagli procedure gives the best results for patch urethroplasty of the bulbar urethra. *BJU Int* 2001; 88: 385–9
- Elliot SP, Metro MJ, McAninch JW. Long term follow up of ventrally placed buccal mucosa onlay graft in bulbar urethral reconstruction. *J Urol* 2003; 169: 1754–7
- Alsifaki NF, Arrendondo SA, McAninch JW. The efficacy of penile fasciocutaneous flaps in the treatment of urethral strictures caused by BXO. *J Urol* 2004; 171: 70A
- Venn SN, Mundy AR. Urethroplasty for balanitis xerotica obliterans. *BJU Int* 1998; 81: 735–7
- Depasquale I, Park AJ, Bracka A. The treatment of balanitis xerotica obliterans. *BJU Int* 2000; 86: 459–65
- Alsifaki NF, Karapetian A, Elliot SP *et al.* The versatility of buccal grafts in the treatment of urethral stricture disease. *J Urol* 2004; 171: 242A
- Armenakas N, McAninch JW. Management of fossa navicularis strictures. *Urol Clin North Am* 2002; 29: 477–84
- Jordan GH. Reconstruction of the fossa navicularis. *J Urol* 1987; 138: 102–4
- Morey AF, Pace PC, McAninch JW. Failed anterior urethroplasty: guidelines for reconstruction. *J Urol* 1997; 158: 1383–7
- Orandi A. One-stage urethroplasty. *Br J Urol* 1968; 40: 717–9
- Morey AF, Tran LK, Zinman LM. Q-flap reconstruction of panurethral strictures. *BJU Int* 2000; 86: 1039–42
- McAninch JW, Morey AF. Penile circular fasciocutaneous skin flap in 1-stage reconstruction of complex anterior urethral strictures. *J Urol* 1998; 159: 1209–13
- Dubey D, Bansal P, Kumar A *et al.* Substitution urethroplasty for anterior urethral strictures: a critical appraisal of various techniques. *BJU Int* 2003; 91: 215–8
- Pansadoro V, Emilliozi P, Gaffi M, Scarpone P. Buccal mucosa urethroplasty for the treatment of bulbar urethral strictures. *J Urol* 1999; 161: 1501–3
- Wessells H, McAninch JW. Current controversies in anterior urethral stricture: free graft versus pedicled skin flap reconstruction. *World J Urol* 1998; 16: 175–80
- Heinke T, Gerharz EW, Bonfig R, Riedmiller H. Ventral onlay urethroplasty using buccal mucosa for complex stricture repair. *Urology* 2003; 61: 1004–7
- Bhandari M, Dubey D, Verma BS. Dorsal or ventral placement of the preputial/penile skin onlay flap for anterior urethral strictures: does it make a difference? *BJU Int* 2001; 88: 39–43
- Barbagli G, Selli C, Tosto A *et al.* Dorsal free graft urethroplasty. *J Urol* 1996; 155: 123–6
- Asopa HS, Garg M, Singhal GG, Singh L, Asopa J, Nischal A. Dorsal free graft urethroplasty for anterior urethral stricture by ventral sagittal approach. *Urology* 2001; 58: 657–9
- Wessells H, McAninch JW. Use of free grafts in urethral stricture reconstruction. *J Urol* 1996; 155: 1912–5
- Grady JD, McCammon K, Schlossberg SM *et al.* Buccal mucosa graft for penile urethral strictures. *J Urol* 1999; 161: 375A
- Gupta NP, Ansari MA, Dogra PN, Tandon S. Dorsal buccal graft urethroplasty by a ventral sagittal urethrotomy and minimal-access perineal approach for anterior urethral stricture. *BJU Int* 2004; 93: 1287–90
- Wessells H, Morey AF, McAninch JW. Single stage reconstruction of complex anterior urethral strictures: combined tissue transfer techniques. *J Urol* 1997; 157: 1271–4
- Berglund R, Angermeier KW. Combined buccal mucosa graft and genital skin flap

for reconstruction of extensive urethral strictures. *J Urol* 2004; 171: 1168A

- 27 Andrich DE, Greenwell TJ, Mundy AR. The problems of penile urethroplasty with particular reference to 2-Stage reconstructions. *J Urol* 2003; 170: 87-9

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Abbreviations: BMG, buccal mucosa graft; BXO, balanitis xerotica obliterans.

#### EDITORIAL COMMENT

This paper continues to reveal the versatility of buccal mucosa as a urethral substitute in all anterior urethral strictures, both as a single

or staged procedure, and it must now be considered the tissue of first choice in all anterior urethroplasties.

However, I was surprised at the significant graft loss (two of 17) given the excellent 'take' characteristics of buccal mucosa, and assume that this was related to technique, as the subsequent re-graft take was good. I also disagree with the authors that dorsal placement of proximal bulbar grafts is easier than ventral placement, and have always considered proximal bulbar strictures a contraindication to dorsal grafts, a view supported by Barbagli (personal communication). I would also be concerned about leaving lichen sclerosus tissue (BXO by definition is confined to the glans and prepuce) behind in the urethra, as it is likely to progress, compromising the repair.

Finally, although this paper makes the case for using buccal mucosa at all sites, it is disappointing that this large series (92 cases) uses such a poor definition of 'cure' and chooses to report results at mean intervals with such large ranges. If we are to advance our knowledge meaningfully in urethroplasty, we must standardize 'cure' and report results at fixed times, i.e. short-term results at 1 year and medium-term results at 5 years.

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