

Two-Sided Bulbar Urethroplasty Using Dorsal Plus Ventral Oral Graft: Urinary and Sexual Outcomes of a New Technique

Enzo Palminteri,* Elisa Berdondini, Ahmed A. Shokeir, Luca Iannotta, Vincenzo Gentile and Alessandro Sciarra

From the Center for Urethral and Genitalia Reconstructive Surgery, Arezzo (EP, EB), U. Bracci Department of Urological Sciences, "La Sapienza" University, Rome (LI, VG, AS), Italy, and Urology & Nephrology Center, Mansoura, Egypt (AAS)

Abbreviations and Acronyms

AU = anastomotic urethroplasty

BM = buccal mucosa

DVG = dorsal plus ventral graft

EAU = extended anastomotic urethroplasty

EPA = excision and primary anastomosis

Qmax = peak flow rate

Submitted for publication September 10, 2010.

Supplementary material for this article can be obtained at www.urethralesurgery.com.

* Correspondence: Center of Urethral and Genital Reconstruction, Via Fra' Guittone 2, 52100 Arezzo, Italy (telephone: +39 335 7012783; FAX: +39 0575 27056; e-mail: enzo.palminteri@inwind.it).

See Editorial on page 1564.

Purpose: Repair of bulbar strictures using anastomotic techniques may cause sexual complications, while 1-side graft urethroplasties may not be sufficient to provide an adequate lumen in narrow strictures. We evaluated the urinary and sexual results of a 2-sided dorsal plus ventral graft urethroplasty by preserving the narrow urethral plate in tight strictures.

Materials and Methods: Between 2002 and 2010, 105 men with bulbar strictures underwent dorsal plus ventral graft urethroplasty. The results are reported in a homogeneous group of 73 of 105 cases in which buccal mucosa was used as a graft with findings after 1 year or more of followup. The urethra was opened ventrally, and the exposed dorsal urethra was incised in the midline to create a raw area over the tunica albuginea where the first graft was placed dorsal-inlay. Thereafter the urethra was augmented by the ventral-onlay second graft and the spongiosum was closed over itself. Successful urethral reconstruction was defined as normal voiding without the need for any postoperative procedure. Postoperative sexual dysfunction was investigated using a validated questionnaire.

Results: Mean followup was 48.9 months and mean stricture length was 3.3 cm. Of these 73 cases 64 (88%) were successful and 9 (12%) were treatment failures with re-stricture. Furthermore, of 49 of 73 cases who were preoperatively sexually active, none reported postoperative erectile impairment and all were satisfied with their sexual life.

Conclusions: In cases of tight bulbar stricture the dorsal plus ventral buccal mucosa graft provides adequate urethral augmentation by preserving the urethral plate and avoiding postoperative sexual complications.

Key Words: urethra, urethral stricture, transplants, mouth mucosa

BULBAR urethral strictures are treated with various reconstructive techniques.^{1–4} Generally short strictures (less than 2 cm) are treated with excision and AU while longer strictures are repaired by patch urethroplasty, preferably using a buccal mucosa graft. In 1996 Barbagli et al introduced the dorsal grafting procedure through a dorsal urethrotomy approach.⁵ Morey and McAninch reported results obtained with the ventral graft technique.⁶ In 2001 Asopa

et al described the dorsal graft urethroplasty using a ventral urethrotomy approach.⁷ Recently the location of the patch has become a contentious issue with various series using the graft placed ventrally or dorsally to augment the urethra.^{4,8,9} However, AU showed a significant incidence of sexual complications and 1-side graft procedures could be insufficient to provide a lumen of adequate width in strictures with a particularly narrow area.^{2,10–13}

Recently we described a new technique for the repair of tight bulbar strictures, consisting of a combined DVG urethroplasty, without transecting the urethra but augmenting the preserved narrow urethral plate to obtain adequate urethral augmentation and to avoid sexual complications.¹⁴ In this report we describe our technique following further experience, functional results obtained in a larger population and with a followup of more than 1 year, and results in terms of sexual outcome.

MATERIALS AND METHODS

From March 2002 to March 2010, 105 male patients with tight bulbar urethral strictures underwent DVG urethroplasty at our center. We analyzed a homogeneous group of 73 of 105 cases in which BM had been used as graft and with a followup of 1 year or more. Seven patients were excluded from study because foreskin plus BM had been used as grafts, and 8 were excluded because heterologous porcine small intestinal submucosa was used as graft.¹⁵ There were 17 patients excluded from analysis because followup was less than 1 year.

Mean $\pm$ SD patient age was 39.2 ± 14.48 years (range 8 to 78). Stricture etiology was unknown in 46 (63%) cases, catheter in 20 (27%), trauma in 3 (4%), instrumentation in 3 (4%) and infection in 1 (1%). Stricture length was 1 to 2 cm in 13 (18%) patients, greater than 2 to 3 cm in 33 (45%), greater than 3 to 4 cm in 19 (26%), greater than 4 to 5 cm in 4 (5%), greater than 5 to 6 cm in 2 (3%) and greater than 6 cm in 2 (3%). Mean stricture length was 3.3 cm (range 1 to 10).

A total of 51 of 73 patients (70%) had undergone previous treatments before referral to our center, with dilation in 2 (3%), internal urethrotomy in 29 (40%) and multiple treatments in 20 (27%). In cases previously managed with urethrotomy the number of urethrotomies ranged from 1 to 9

(mean 4). Preoperative evaluation included clinical history, physical examination, urine culture, uroflowmetry, retrograde voiding cystourethrography and urethroscopy.

Surgical Technique

With the patient in the lithotomy position, a Y-inverted perineal incision was made and the bulbocavernosus muscles were divided, exposing the bulbar urethra. Using a ventral-sagittal urethrotomy the strictured urethra was opened with the aid of a guidewire and methylene blue previously injected to define the narrow lumen. This step avoided losing the lumen and did not damage the urethral plate during the urethral opening. The urethra was left open for 1 cm proximally and distally in the healthy urethra.

Dorsal Graft

As suggested by Asopa et al the exposed dorsal urethra was incised in the midline down to the tunica and the margins of the incised dorsal urethra were dissected from the tunica albuginea without lifting the 2 halves of the bisected urethra.⁷ An elliptical raw area was created where the first graft was placed as a dorsal inlay, quilted to the corpora cavernosa and sutured to the urethral margins (fig. 1, A).

Ventral Graft

Following dorsal augmentation the urethra was also graft enlarged ventrally according to procedures reported by others.^{6,12} The second graft was sutured laterally to the left mucosal margin of the urethral plate with a running 6-zero suture. The catheter was inserted, and the graft was rotated and sutured laterally to the right mucosal margin (fig. 1, B). Thus, a neourethra was created by anastomosis of the BM grafts in an inlay/onlay patch fashion to the mucosal margins of the bisected urethral plate. Finally, the spongiosum was closed over the ventral graft with a 4-zero running suture (fig. 2).

The double patch was used to better enlarge the urethra in tight strictures characterized by a narrow residual

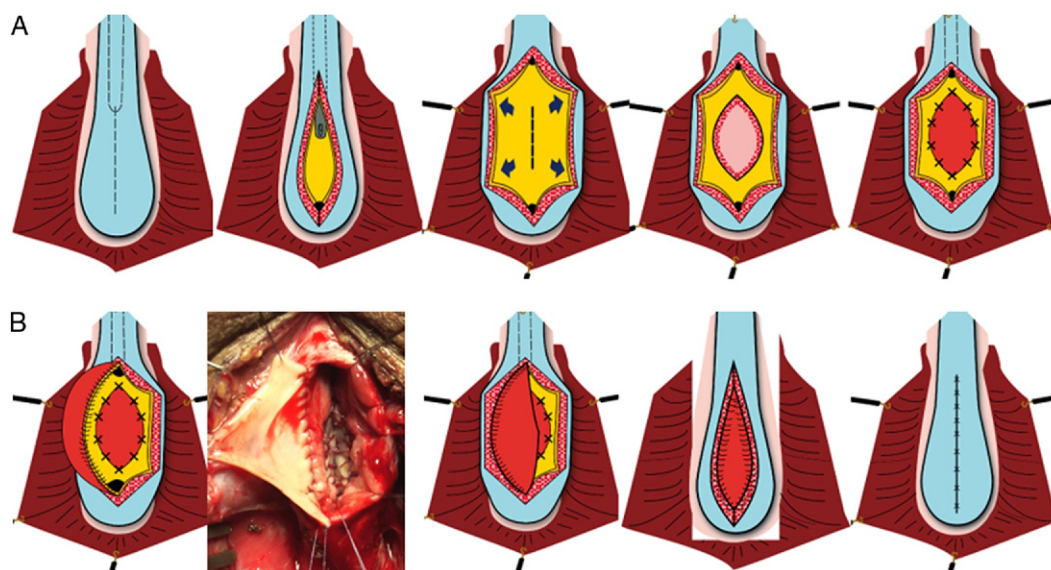


Figure 1. A, dorsal inlay graft urethral augmentation using ventral urethrotomy approach. B, ventral onlay graft completes urethral augmentation.

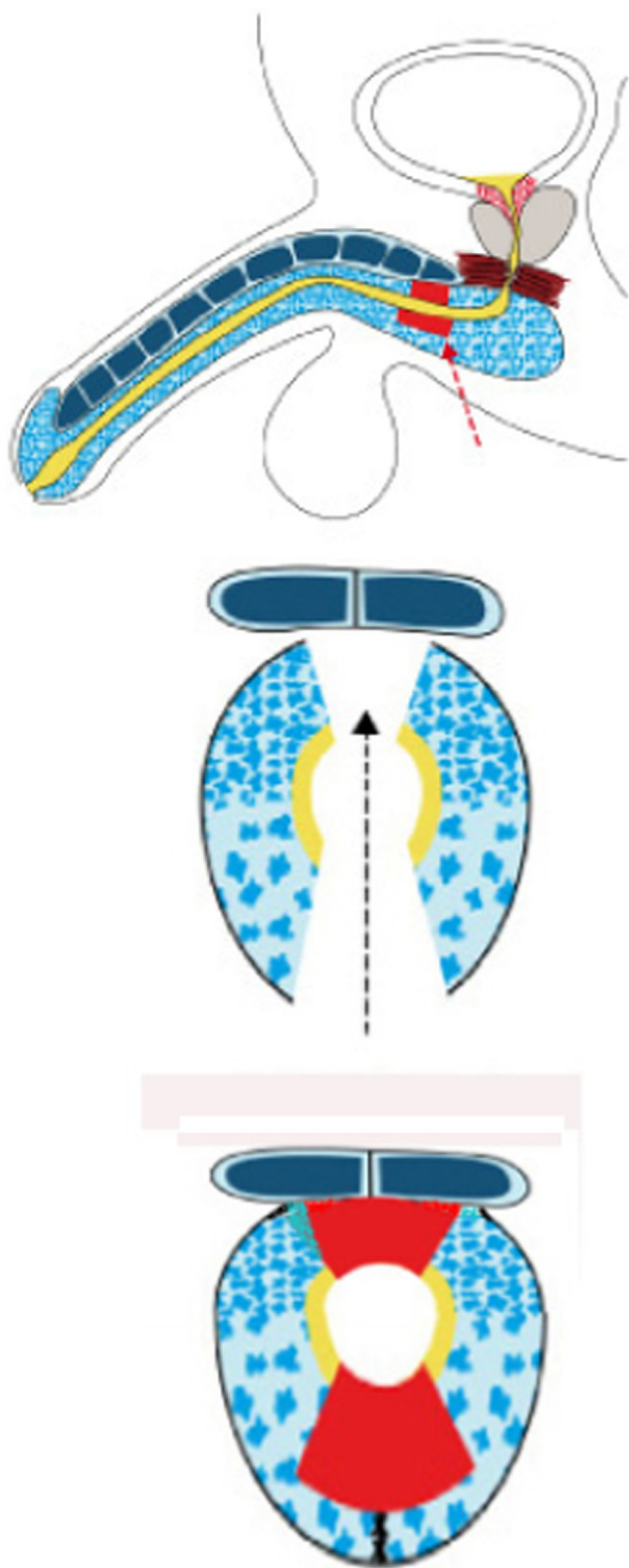


Figure 2. Dorsal plus ventral double graft augmentation of urethra

urethral plate, scarred and/or compromised by stenotic rings, in which a single patch appeared inadequate to make a sufficiently wide lumen. Preoperative urethrogram provided information regarding the degree of urethral narrow-

ing (fig. 3). However, the intraoperative urethral conditions determined the choice of surgical technique.

A 2-team approach was used with 1 team harvesting the BM while the 2nd team exposed the stricture. The BM was harvested from the cheek. In 68 patients a single graft was harvested from only 1 cheek (right in 67 patients and left in 1), and thereafter tailored into 2 smaller grafts according to the length of the dorsal and ventral openings of the urethra, while in 5 patients the 2 BM grafts were harvested bilaterally from both cheeks.

Mean length of the harvested BM graft was 6 cm (range 4.5 to 8) and mean width was 1.8 cm (range 1 to 2.5). Overall mean length of the dorsal graft augmentation was 2.3 cm (range 1 to 10) and mean length of the ventral graft augmentation was 4.4 cm (range 2 to 11). In 1 case 2 dorsal BM grafts were placed serially (total length 10 cm) plus 1 ventral BM graft. In another case 1 dorsal BM graft was used plus 2 ventral BM grafts (total length 11 cm) placed serially. A 16 to 18Fr silicone Foley catheter was left in situ. Patients were discharged home after 3 days. Voiding cystourethrography was performed upon catheter removal 3 weeks after surgery.

Postoperative Assessment

Followup assessment included uroflowmetry and urine culture every 4 months in postoperative year 1 and annually thereafter. Urethrography and urethroscopy were performed in patients presenting with obstructive symptoms or Qmax less than 14 ml per second. Clinical outcome was considered a failure when any postoperative procedure was needed, including dilation.

The prevalence of postoperative sexual disorders was investigated using the validated questionnaire previously adopted by Morey and Kizer¹⁰ and Coursey et al¹⁶ in their series of urethroplasties (see Appendix). The questionnaire was delivered by mail 1 year after surgery to 49 sexually active patients selected according to age (range



Figure 3. Voiding urethrogram showing tight bulbar stricture in which single graft augmentation could be insufficient.

18 to 60 years old), no diabetes or vascular disease present and no further treatment required following our urethroplasty. This questionnaire was used since an aim of the present investigation was to assess the subjective postoperative changes and to compare our data with findings reported by others using the same questionnaire.¹⁰

RESULTS

Mean followup was 48.9 months (range 12 to 93). Of the 73 cases 64 (88%) were successful and 9 (12%) were considered treatment failures. There were no early postoperative complications such as wound infections, hematomas or bleeding. In 4 cases at voiding urethrography following catheter removal at 3 weeks a mild leakage at the graft anastomosis was observed. However, this resolved spontaneously with a 12Fr catheter for 2 additional weeks.

In the 64 successful cases mean postoperative Qmax was 30.2 ml per second (vs mean preoperative Qmax 7.5 ml per second), mean stricture length was 3.3 cm (range 1 to 8), mean dorsal graft length 2.2 cm and mean ventral graft length 4.4 cm. In the 9 cases of treatment failure the mean stricture length was 3.9 cm (range 2 to 10), mean dorsal graft length was 3.3 cm and mean ventral graft length was 4.4 cm. Of the 9 cases of treatment failure re-strictures less than 1.5 cm developed in 6 and they were managed with internal urethrotomy. Re-stricture greater than 3 cm developed in 3 patients. The fibrotic urethral tract was opened leaving a perineal urethrostomy and the patients are currently awaiting a staged solution. Recurrence developed within 1 year after surgery in 3 cases, within 2 years in 3 and within 3 years in 3.

None of the 49 sexually active men reported postoperative penile curvature or shortening, impaired erection, or dissatisfaction regarding erection and sexual activity compared to preoperative status. Moreover erectile improvement was reported by 7 patients (14%) and by 3 partners (6%), increased frequency of intercourse was reported by 2 (4%) and ejaculatory improvement was reported by 6 (12%). Only 2 patients (4%) reported decreased ejaculatory flow and 1 (2%) reported slightly decreased glans sensitivity. All 49 (100%) patients reported overall satisfaction following urethroplasty. Compared to data reported by other authors using the same erectile function questionnaire following AU our data showed better results (see [table](#)).¹⁰

DISCUSSION

Graft Techniques

Long bulbar strictures are usually treated with dorsal or ventral oral graft urethroplasty.^{4,8,9,12} Dorsal grafting is performed using the approach of Barbagli or Asopa. A disadvantage of the former approach is a

Postoperative sexual function results based on sexual function questionnaire

	% DVG	% EPA*	% EAU†
Erection improvement	14	—	—
Erection worsening	0	—	—
Complete loss of erections	0	18	0
Chordee	0	44	0
Decreased penile length	0	22	33
Increased penile length	2	—	—
Decreased intercourse frequency	0	22	16
Increased intercourse frequency	4	—	—
Post-ejaculation dribble	4	—	—
Ejaculatory improvement	12	—	—
Decreased ejaculatory flow	4	—	—
Erectile worsening noted by partner	0	33	16
Erectile improvement noted by partner	6	—	—
Decreased glans sensitivity	2	—	—
Overall satisfaction	100	55	83

* For strictures 2.5 cm or less.

† For strictures larger than 2.5 cm.

more extensive dissection-mobilization of the urethra. This approach might impair erection and the bulbar arteries when dissection from the corpora is proximal.^{9,17} Asopa's procedure is easier to perform because the urethra is not dorsally mobilized. Nevertheless, the augmentation is not as wide as that achieved using the approach of Barbagli.⁷ With regard to the ventral grafting Elliott et al stated that the graft may be inadequate to augment a narrow urethral plate and, in these cases, suggested a wider graft.¹²

Barbagli stated that his technique offered a wider augmentation than ventral or dorsal grafting using the ventral urethrotomy approach.¹³ He suggested that the technique (ventral or dorsal graft) should be selected according to the width of the urethral plate. In reality the urethral plate can be assessed only after urethral opening because the urethrogram often underestimates the severity of the stricture.¹⁸ Ventral urethrotomy provides easy access to the urethra that with good visualization of the urethral plate allows one to establish whether a dorsal or a ventral graft would be more appropriate. Furthermore, in tight strictures with a narrow urethral plate in which a single patch is insufficient for the reconstruction of an adequate lumen, ventral access allows the performance of double dorsal-ventral grafting.^{14,15}

Rationale of DVG Technique

In 2008 we described the DVG for tight bulbar strictures, postulating some advantages.¹⁴ The fibrotic tissue is partially excised while preserving the remaining urethral plate. Avoiding a wide single ventral graft, double grafting may reduce the possibility of fistula and diverticula. Dorsal augmentation could be small due to reduced mobilization of the urethral plate that the ventral approach allows. Thus, the additional second graft could correct the initial use of a single dorsal

graft that was intraoperatively considered insufficient for adequate augmentation.

In nonobliterative short strictures the DVG represents an alternative to the aggressive AU since in avoiding transection of the spongiosum it preserves the urethral plate.^{14,18} The aim of DVG is to maintain the integrity of the urethral vascularity and the urethral length, thus reducing the sexual complications related to AU.^{10,11,16,19–21}

Anastomotic Techniques

Short bulbar strictures (less than 2 cm) are traditionally treated with EPA. Recently EAU has been described for stenoses even up to 5 cm.¹⁰ However, in addition to the excision, the spatulation of the stumps lengthens the gap, increasing the risk of complications.^{19,22} Following the urethral transection the stricture is often longer than described at urethrography and this discrepancy causes problems when performing AU. Unlike the transverse section the ventral urethrotomy offers the possibility of choosing an appropriate solution after evaluation of the stricture and its length.

AU showed a more important impact on sexual life than that of graft techniques.^{2,10,11,16,20,23} Focusing on bulbar repair the literature showed a significant rate of sexual complications following AU. Barbagli et al reported cold glans (11.6%) and glans not full during erection (18.3%).¹¹ These complications may be related to vascular injury in the spongiosum distally to the transection. Al-Qudah and Santucci, directly comparing AU vs BM graft techniques in bulbar repairs, showed a higher incidence of sexual complications following AU, and they were the first to highlight the issue of graft vs AU for short bulbar strictures.^{21,24}

Urinary and Sexual Results of DVG Technique

In our series population characteristics (age, stricture length and etiology), criteria of urinary outcomes and followup were comparable to those used in other studies.^{4,8,9,16,23} A successful urinary outcome of 88% was achieved but we realize that a stronger followup methodology could detect unrecognized re-strictures.⁴ With regard to our short re-strictures treated with urethrotomy which are successful at the moment, we emphasize that many recurrences after BM urethroplasty are diaphragms or rings occurring at the anastomotic site between the graft and urethra. This explains why these rings could be successfully dispelled by a simple urethrotomy. These should be considered differently from true longer recurrences associated with a wider spongiofibrosis.⁴

Our sexual results were compared to those previously reported using the same sexual questionnaire after AU (see table).¹⁰ Even if differences in results between the 2 series could be due in part to differences in population characteristics, we highlight

that in our experience no preoperatively sexually active men reported postoperative erectile impairment or overall dissatisfaction regarding sexual life. A positive impact on erectile function was noted postoperatively in 14% of cases (vs complete loss of erection in 18% with EPA) and an increased frequency of intercourse was reported in 4% (vs a decreased frequency in 22% and 16% of cases with EPA and EAU, respectively).¹⁰

Sexual complications after AU have an impact on quality of life, which may be a more important issue than the risk of re-stricture. Successful outcomes in urethral repair should be assessed not only by objective voiding parameters but also by subjective parameters influencing patient satisfaction, which must be considered in the choice of treatment. Larger series and adapted validated questionnaires are necessary to establish whether DVG techniques represent an alternative to traditional anastomotic techniques which are now supported by the current evidence as the method of choice.

CONCLUSIONS

The optimal technique for bulbar urethral stricture repair should guarantee optimal urinary and sexual outcomes. DVG urethroplasty is a valid technique that offers the possibility of performing a wide urethral enlargement also in severe strictures by preserving the urethral plate and length. This technique guarantees good urinary outcomes preserving, at the same time, sexual function. Later graft failure may contribute to deterioration of the final outcome. Therefore, direct comparison of the different techniques is necessary to clarify the various results.

APPENDIX

Patient Questionnaire

- 1) How would you describe your erections before surgery?
Absent - Not at all satisfactory - Moderately satisfactory - Very satisfactory
- 2) How would you describe your erections after surgery?
Absent - Not at all satisfactory - Moderately satisfactory - Very satisfactory
- 3) Has the angle of your erection changed after surgery?
Not at all - Somewhat - Quite a bit
If so, has this symptom improved over time?
Not at all - Somewhat - Quite a bit
Comments:
- 4) Has the length of your penis changed since your surgery?
Not at all - Somewhat - Quite a bit
If so, has this symptom improved over time?
Not at all - Somewhat - Quite a bit
Comments:
- 5) Has your partner noticed any changes in your erections since surgery?

Yes - No

Comments:

- 6) Have you altered your frequency of intercourse due to erection changes since surgery?

Not at all - Somewhat - Quite a bit

7) How would you describe your health in general?

Poor - Fair - Good - Excellent

REFERENCES

1. Santucci RA, Mario LA and McAninch JW: Anastomotic urethroplasty for bulbar urethral stricture: analysis of 168 patients. *J Urol* 2002; **167**: 1715.
2. Eltahawy EA, Virasoro R, Schlossberg SM et al: Long-term follow up for excision and primary anastomosis for anterior urethral strictures. *J Urol* 2007; **177**: 1803.
3. Andrich DE and Mundy AR: What is the best technique for urethroplasty? *Eur Urol* 2008; **54**: 1031.
4. Patterson JM and Chapple CR: Surgical techniques in substitution urethroplasty using buccal mucosa for the treatment of anterior urethral strictures. *Eur Urol* 2008; **53**: 1162.
5. Barbagli G, Selli C, Tosto A et al: Dorsal free graft urethroplasty. *J Urol* 1996; **155**: 123.
6. Morey AF and McAninch JW: When and how to use buccal mucosal grafts in adult bulbar urethroplasty. *Urology* 1996; **48**: 194.
7. Asopa HS, Garg M, Singhal GG et al: Dorsal free graft urethroplasty for urethral stricture by ventral sagittal urethrotomy approach. *Urology* 2001; **58**: 657.
8. Kane CJ, Tarman GJ, Summerton DJ et al: Multi-institutional experience with buccal mucosa onlay urethroplasty for bulbar urethral reconstruction. *J Urol* 2002; **167**: 1314.
9. Barbagli G, Palminteri E, Guazzoni G et al: Bulbar urethroplasty using buccal mucosa grafts placed on the ventral, dorsal or lateral surface of the urethra: are results affected by the surgical technique? *J Urol* 2005; **174**: 955.
10. Morey AF and Kizer WS: Proximal bulbar urethroplasty via extended anastomotic approach—what are the limits? *J Urol* 2006; **175**: 2145.
11. Barbagli G, De Angelis M, Romano G et al: Long-term follow up of bulbar end-to-end anastomosis: a retrospective analysis of 153 patients in a single center experience. *J Urol* 2007; **178**: 2470.
12. Elliott SP, Metro MJ and McAninch JW: Long-term follow up of the ventrally placed buccal mucosa onlay graft in bulbar urethral reconstruction. *J Urol* 2003; **169**: 1754.
13. Barbagli G: Editorial comment on: Dorsal buccal mucosal graft urethroplasty for anterior urethral stricture by Asopa technique. *Eur Urol* 2009; **56**: 205.
14. Palminteri E, Manzoni G, Berdondini E et al: Combined dorsal plus ventral double buccal mucosa graft in bulbar urethral reconstruction. *Eur Urol* 2008; **53**: 81.
15. Palminteri E, Berdondini E, Colombo F et al: Small intestinal submucosa (sis) graft urethroplasty: short-term results. *Eur Urol* 2007; **51**: 1695.
16. Coursey JW, Morey AF, McAninch JW et al: Erectile function after anterior urethroplasty. *J Urol* 2001; **166**: 2273.
17. Anger JT, Sherman ND and Webster GD: The effect of bulbar urethroplasty on erectile function. *J Urol* 2007; **178**: 1009.
18. Abouassaly R and Angermeier KW: Augmented anastomotic urethroplasty. *J Urol* 2007; **177**: 2211.
19. Guralnick ML and Webster GD: The augmented anastomotic urethroplasty: indications and outcome in 29 patients. *J Urol* 2001; **165**: 1496.
20. Mundy AR: Results and complications of urethroplasty and its future. *Br J Urol* 1993; **71**: 322.
21. Al-Qudah HS and Santucci RA: Buccal mucosal onlay urethroplasty versus anastomotic urethroplasty (AU) for short urethral strictures: which is better? *J Urol*, suppl., 2006; **175**: 103, abstract 313.
22. Webster GD, Koefoot RB, Sihelnik SA et al: Urethroplasty management in 100 cases of urethral strictures: a rationale for procedure selection. *J Urol* 1985; **134**: 892.
23. Kessler T, Fish M, Heitz M et al: Patient satisfaction with the outcome of surgery for urethral strictures. *J Urol* 2002; **167**: 2507.
24. Al-Qudah HS, Cavalcanti AG, and Santucci RA: Early catheter removal after anterior anastomotic (3 days) and ventral buccal mucosal onlay (7 days) urethroplasty. *Int Braz J Urol* 2005; **31**: 459.