

·Clinical Experience·

Single stage dorsal inlay buccal mucosal graft with tubularized incised urethral plate technique for hypospadias reoperations

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Abstract

Aim: To report the experience with single stage dorsal inlay buccal mucosal grafts using the Snodgrass technique for complex redo cases. **Methods:** From May 2004 to December 2005, a total of 53 patients aged from 3 to 34 years old (average 11.62 ± 7.18 years) with failed previous hypospadias surgery were included in the present study. Indications included urethral strictures and repair breakdown. The unhealthy urethra was unroofed from the meatus in the ventral midline, a buccal mucosal graft was inlayed between the incised urethral plate and fixed to the corpora cavernosa. The neourethra was tubularized, and covered with subcutaneous (dartos) tissue and penile skin. Glanuloplasty was also performed in all cases. Outcome analysis included clinical follow-up, and endoscopy in 2 selected cases. **Results:** The buccal mucosal graft was 3.0–7.5 cm in length and 0.7–2.0 cm in width. All patients required glanuloplasty, with buccal mucosal grafts extended to the tip of the glans. After a follow-up of 14–30 months (mean 22.6 months), the total complication rate was 15.1%, with five cases of fistula and three cases of stricture. **Conclusion:** Inlaying dorsal buccal mucosal grafts applying the Snodgrass technique is a reliable method for creating a substitute urethral plate for tubularization. The recurrent rate of urethral stricture and fistula is at an acceptable level for redo cases. This approach represents an effective, simple and safe option for reoperations. (*Asian J Androl* 2008 Jul; 10: 682-686)

Keywords: hypospadias; buccal mucosal graft; urethroplasty

1 Introduction

Although primary hypospadias reconstruction yields excellent success rates, some patients require multiple operations to achieve ultimate repair [1, 2]. For this reason, a broad variety of reoperative techniques are in use. If healthy tissue is still available, the success rates are high [3–5]. In many reoperative cases, the urethral plate has been removed or is severely scarred, rendering it

unsuitable for localized salvage repair by Snodgrass technique [6]. Consequently, the urethral plate must be augmented or substituted for further tubularization. Localized onlay or tubularized pedicled flap procedures yield complication rates up to 30% and 56%, respectively [1, 4]. According to Schwentner *et al.* [7], use of inlay skin grafts has a complication rate of 16%, and lack of available skin and poor cosmetic outcome are limiting factors. Single stage buccal grafts with tubularized incised urethral plates (TIP), described by Hensle [8], are used for the salvage of distal urethral stricture. Although the recipient bed is potentially scarred, dorsal free grafts still reliably establish neovascularity. So, single stage urethral plate augmentation with tubularization has been suggested. We reported our experience and interim outcome using inlay buccal mucosal grafts (BMG) of a

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modified TIP technique for severe hypospadias reoperation in children and adults requiring urethral plate substitution or augmentation.

2 Materials and methods

A total of 53 patients ranging from 3 to 34 years (mean age 11.62 ± 7.18 years) were enrolled with parental or individual consent. These patients had previously undergone 1–6 (mean 2.12 ± 1.76) failed hypospadias repairs. Patients with urethral stricture complained about post-void dribbling and urethral dilation every 1 or 2 weeks. Preoperative evaluation mainly included clinical investigation. Urethral stricture (37 cases) and repair breakdown (16 cases) were considered indications and included in this group.

The surgical procedure is performed with the patient under general anesthesia and tracheal intubation. Along the ventral penile midline, the urethra was unroofed from the meatus until healthy tissue was encountered. The opened urethra was defined as a new “urethral plate”. The virgin urethral plate had already been removed or grossly scarred during previous surgery, rendering it unsuitable for localized salvage procedures. The scar was excised meticulously to release the penile curve, leaving urethral plate defects ranging from 3.0 cm to 7.5 cm long (mean length, 4.59 ± 2.16 cm). If chordee still persisted after scar removal, tunica albuginea plication was performed until an artificial erection test showed the penile restored straight. In cases of severe chordee that could not be corrected by plication, the remnant urethral plate was transected and buccal mucosal was patched between the dissected stumps, with a second operation performed 6 months later to tubularize a new urethra.

The graft was harvested from lower lip mucosa. If there was not enough, cheek mucosa was used. All grafts were accurately freed from adherent subcutaneous fat and connective tissue. The tailored BMG was inserted between the split urethral plate, stitched to the margins to the healthy urethra using interrupted 7-0 or 6-0 absorbable sutures in a tension free manner (Figures 1 and 2). The patch was fixed to the tunica albuginea using two to three stitches in the middle, guaranteeing sufficient blood supply. The edges of the augmented urethral plate substitute were then tubularized over an indwelling catheter (8–16 Fr feeding tube) using 7-0 or 6-0 polydioxanone sutures.



Figure 1. Urethral plate was incised at midline. The tailored buccal mucosal graft was inserted between the split urethral plate.

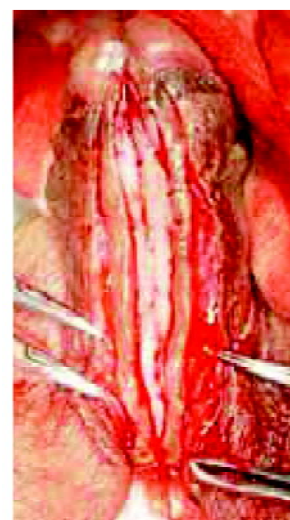


Figure 2. The buccal mucosal graft was inlayed to the medial edge of the split healthy urethra using interrupted sutures.

The glanular wings were separated from the distal urethral plate by parallel longitudinal incision, and reconstruction was started at the neomeatus proceeding to the corona with tension free closure. To provide a barrier layer for the neourethra, subcutaneous tissue was placed over the neourethra as the second layer [9]. Finally, the penile shaft and the scrotal skin was superficially closed by “Z” plasty to prevent wound contracture and



Figure 3. Shaft and glans are closed by "Z" plasty, and the meatus is slit-like and in an orthotopic position.

fistula (Figure 3). We used a transparent dressing (Tegaderm; 3M Health Care, St. Paul, MN, USA) and Coban (3M Health Care, St. Paul, MN, USA) as post-operative penile dressing for 1 week, to help relieve post-operative swelling. The catheter remained indwelling for 9–12 days. The follow-up protocol consisted of clinical investigation, and endoscopy was performed only in selected cases.

Generally, the clinical outcome was considered a failure when any complication occurred. Numerical data are expressed as mean \pm SD.

3 Results

A total of 53 men aged 3–34 years underwent single stage hypospadias reoperation. Follow-up ranged from 12 to 30 months (mean 22.6 ± 10.2 months). All patients were available for follow-up examinations. The last repair procedures before were Onlay or Duckett's methods [10] in 15 patients, TIP in 20, bladder mucosa in 12, and six with unknown. Most patients required inlayed grafts 3–5 cm long, with inlayed lengths of 4.59 ± 2.16 cm (range 3.0–7.5 cm).

Eight cases required further instrumentation or surgery (complication rate is 15.1%). Fistula developed in five patients (9.4%) 1 and 2 weeks after catheter removal due to infection caused by scrotum effusion. They were treated by rotation of a local dartos flap, with no recurrence to date (16–25 months). Recurrent stricture of proximal occurred in three patients (5.7%). Single inter-

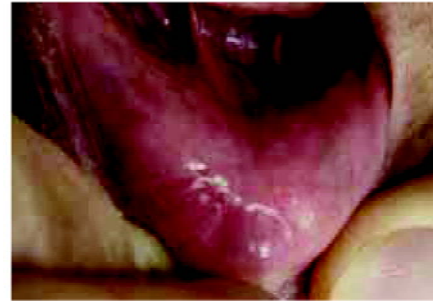


Figure 4. Result of donor site in 4 weeks.



Figure 5. A 1-month follow-up endoscopy shows a buccal mucosal graft almost indistinguishable from native urethra.

nal urethrotomy was sufficient in one patient, and two patients needed additional urethroplasty using the same technique with a successful outcome to date (11–18 months). Of the eight failures, five were made at the beginning of our learning curve. There were no diverticulum and mucosal extrophy at meatus. The meatus was slit-like, and all the patients were satisfied with the cosmetic appearance.

All patients reported only slight oral discomfort at the donor site in the first 1–2 days postoperatively, and returned to a normal diet 1 day after operation. No aesthetic or functional complications were observed at the donor site after 3 months (Figure 4). From endoscopic evaluation of a patient 4 weeks postoperatively, we found that there is epithelialization over the whole plate without fibrosis (Figure 5).

4 Discussion

Snodgrass described the TIP technique for hypospadias repair in 1994 as a means to widen and improve

the mobilization of the urethral plate when performing a Thiersch–Duplay urethroplasty. Since that time, many reports have been published describing the success of this modified procedure. TIP hypospadias repair has gained widespread acceptance because of its ability to correct different meatal variants, the simplicity of the operative technique, the low complication rate and the reliable creation of a normal appearing glanular meatus. Use of TIP urethroplasty in cases of reoperative hypospadias has also been reported. Yang *et al.* [11] reported seven (28%) fistulae of the neourethra after a reoperative Snodgrass procedure in 25 patients. Snodgrass and Lorenzo [12] reported a 20% reoperation rate after TIP for reoperative cases. For those patients who have undergone several failed reconstruction attempts, the fibrosis and scarring seen in these circumstances can make an adequate meatus and urethra more difficult to achieve, and the TIP technique is unsuitable because of the relatively high rate of stricture (up to 30%) [9]. In an attempt to overcome these difficulties, we have combined the principles of TIP and BMG. The graft is now placed dorsally on an excellent vascular bed of tunica albuginea, with tubularization of the composite urethra, thus hopefully reducing the risk of graft failure and recurrent stenosis.

In our study, a mean of 2.12 prior surgical interventions had been performed. Hence, the urethral plate was severely scarred or absent in all cases. Under these circumstances, most authors proposed a one stage procedure using the graft as a ventral onlay or tube, with a complication rate of 32% and 50%, respectively [13]. Hence, taking a graft as an onlay or tube is not reliable. The high complication rate of grafts used either as onlay or tube may be explained by poor vascularity, because they are not densely fixed to the surrounding tissue, and are more susceptible to adverse effects of fluid collection and erections. In addition, the lack of mechanical support allows the graft to fold on itself [14, 15], further reducing the caliber of the neourethra.

Snodgrass and Elmore [6] recently reported on dorsal buccal mucosa grafts in a two stage operation to replace the plate or scarred skin. With this approach, it is supposedly easier to establish vascularization, and the initial graft healing rate is 88%. These patients underwent secondary tubularization subsequently. The overall success rate reported is 65% [6].

Hayes and Malone [9] described a modification of the tubularized incised plate technique by adding a dorsal

free buccal mucosa laid into the incised urethral plate for the salvage of distal urethral strictures. The procedure we applied is the same as what Hayes and Malone [9] reported in three patients with distal urethral strictures. We expanded the scope of indication even to re-do cases with long urethral strictures (the longest stricture was 7.5 cm). The goal of our study was to combine the advantage of a dorsal graft operation using buccal mucosa with the TIP technique and to investigate its short-term and middle-term effects, as there is still no data available regarding long follow-ups for this approach in hypospadias reoperations.

Meticulous scar excision makes the corpora a satisfactory graft bed for a urethral plate substitute. A serious complication of free graft urethroplasty is the necrosis of the patch, caused by vascularization failure from its bed. So the buccal mucosa grafts were thinned, stitched and closely quilted to the surrounding tissue to allow initial blood supply via diffusion [1, 6, 15]. Accurate quilting decreases the likelihood of fluid collection, hematoma and shear forces during erections [6]. Deep glanular scar excision resulted in a slit-like vertical meatus, providing a good cosmetic effect, which might be an additional advantage of the inlay approach. As for the limits of this technique, we think that re-doing hypospadias with very severe chordee might be a contraindication. If the chordee is too severe and can only be corrected by transection of remnant urethra, a relatively larger graft would be needed to patch around the urethra, then the possibility of scar constructure and graft necrosis would increase, which leads to recurrence of stricture. For these cases, a two stage operation is a better choice than a one stage repair.

Current opinion is that, if free extragenital tissue is needed to perform urethroplasty, a BMG provides excellent clinical results. We chose buccal mucosa as an inlay substitute because it has a thick epithelium, good tensile strength, and higher density of elastic fibres than preputial skin, which favors revascularization and inosculation, therefore, increasing the chance of graft take. Additionally, in the instance of failed hypospadias repair, local penile skin or preputial skin is usually deficient, so an exgenital tissue source is required. Experience with split thickness and full-thickness skin grafts as well as bladder mucosa grafts has been reported with less than ideal and less durable results. In the first large patient series published by Duckett *et al.* [16], the histological and immunohistochemical studies show that

the buccal mucosa had the thinnest lamina propria layer while having the greatest native vascular supply, suggesting a reason for the rapid healing of buccal mucosa when used as urethral replacement tissue. Several studies have been published stressing the importance of the site and the technique of buccal mucosa harvesting. In our procedure, the majority of grafts were taken from the inner aspect of the lower lip, because the harvesting there is much easier, and additionally, trauma in the cheek will have more effect during mastication. Complications are minimal. In a prospective study of 49 men who underwent BMG harvest procedures for urethroplasty, 83% experienced postoperation pain at the site of graft harvest [16]. The main long-term complications were persistent perioral numbness in 26% of cases, salivatory changes in 10% and difficulty in opening the mouth in 9% [17–19]. Other complications were bleeding, scarring, and lip retraction. We think the following points are important in the prevention of oral complications. The graft harvested should be thin to avoid bleeding and assist scar healing in the donor site. The width of the graft is kept below 2.5 cm, so the rate of long-term complications, such as numbness and retraction, was low.

There have been few reports published concerning hypospadias reoperations. Schwentner *et al.* [7] reported their interim experience with the dorsal inlay skin graft technique with a complication rate of 16.1%. The dorsal inlay buccal mucosa graft has the advantage of the TIP technique, the enlarged diameter of reconstructive urethra decrease the recurrence of stricture, so it is a reliable method for salvage reconstruction. As to virgin repair of hypospadias, TIP technique should be the first choice. Nevertheless, we still need long-term data, especially in histology, to evaluate accurately the impact of this technique.

Previously failed hypospadias repair continues to be challenging for the urologist. The single stage dorsal inlay BMG approach combines the excellent cosmetic and functional results of the Snodgrass technique with BMG. Given its simplicity, versatility, and the low complication rate, it is a valuable option for complex hypospadias reoperation.

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References

- 1 Manzoni G, Bracka A, Palminteri E, Marrocco G. Hypospadias surgery: when, what and by whom? *BJU Int* 2004; 94: 1188–95.
- 2 Snodgrass W. Tubularized, incised plate urethroplasty for distal hypospadias. *J Urol* 1994; 151: 464–5.
- 3 Snodgrass WT, Lorenzo A. Tubularized incised-plate Urethroplasty for hypospadias reoperation. *BJU Int* 2002; 89: 98–100.
- 4 Simmons GR, Cain MP, Casale AJ, Keating MA, Adams MC, Rink RC. Repair of hypospadias complications using the previously utilized urethral plate. *Urology* 1999; 54: 724–6.
- 5 Leung AK, Robson WL. Hypospadias: an update. *Asian J Androl* 2007; 9: 16–22.
- 6 Snodgrass W, Elmore J. Initial experience with staged buccal graft (Bracka) hypospadias reoperations. *J Urol* 2004; 172: 1720–4.
- 7 Schwentner C, Gozzi C, Lunacek A, Rehder P, Bartsch G, Oswald J, *et al.* Interim outcome of the single stage dorsal inlay skin graft for complex hypospadias reoperations. *J Urol* 2006; 175: 1872–6.
- 8 Hensle TW, Kearney MC, Bingham JB. Buccal mucosa grafts for hypospadias surgery longterm results. *J Urol*, 2002;168: 1734–9.
- 9 Hayes MC, Malone PS. The use of a buccal mucosal graft with urethral incision (Snodgrass) for hypospadias salvage. *BJU Int* 1999; 83: 508–9.
- 10 Duckett JW. Hypospadias. In: Walsh PC, Retik AB, Walsh PC, Retik AB, editors. *Campbell's Urology*, 7th ed. Philadelphia: Saunders 1998, p2093–119.
- 11 Yang SS, Chen SC, Hsieh CH, Chen YT. Reoperative Snodgrass procedure. *J Urol* 2001; 166: 2342–5.
- 12 Snodgrass WT, Lorenzo A. Tubularized incised-plate urethroplasty for hypospadias reoperation. *BJU Int* 2002; 89: 98–100.
- 13 Hensle TW, Kearney MC, Bingham JB. Buccal mucosa grafts for hypospadias surgery long term results. *J Urol* 2002; 168: 1734–6.
- 14 Barbagli G, Palminteri E, Rizzo M. Dorsal onlay graft urethroplasty using penile skin or buccal mucosa in adult bulbourethral strictures. *J Urol* 1998; 160: 1307–9.
- 15 Shukla AR, Patel RP, Caning D. Hypospadias. *Urol Clin North Am* 2004; 31: 445–60.
- 16 Duckett JW, Coplen D, Ewalt D, Baskin LS. Buccal mucosal urethral replacement. *J Urol* 1995; 153: 1660–3.
- 17 Wood DN, Allen SE, Andrich DE, Greenwell TJ, Mundy AR. The morbidity of buccal mucosal graft harvest for urethroplasty and the effect of nonclosure of the graft harvest site on postoperative pain. *J Urol* 2004; 172: 580–3.
- 18 Filipas D, Wahlmann U, Hohenfellner R. History of oral mucosa. *Eur Urol* 1998, 34: 165–8.
- 19 Meneghini A, Cacciola A, Cavarretta L, Abatangelo G, Ferrarrese P, Tasca A. Bulbar urethral stricture repair with buccal mucosa graft urethroplasty. *Eur Urol* 2001; 39: 264–7.

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