

Donor Site Complications of Buccal Mucosa Harvesting in Substitution Urethroplasty

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ABSTRACT

Background: Buccal mucosa is commonly used as the graft of choice in substitution urethroplasty, but donor-site morbidity remains a relevant clinical concern. Evaluating the frequency and predictors of these complications is essential for improving postoperative outcomes. This study aimed to determine the frequency, types, and predictors of donor-site complications following buccal mucosa graft harvesting.

Methods: It was a descriptive prospective study in 74 patients who had undergone buccal mucosa graft urethroplasty within a period of 12 months. Day 1-, 3- and 6-months Donor-site assessments were done. Clinical recording of complications was done. Independent t-tests, chi-square/Fisher exact tests and multivariate logistic regression were used as statistical analysis.

Results: Donor-site complications occurred in 9 patients (12.2%). Edema was noted in 6 (8.1%), difficulty in mouth opening in 3 (4.1%), bleeding in 2 (2.7%), numbness in 2 (2.7%), chewing difficulty in 2 (2.7%), and infection in 1 (1.4%). Overall mouth opening showed minimal reduction, though patients with functional limitation experienced greater declines. Larger graft area (OR 1.12, $p = 0.036$) and diabetes (13 patients, 17.6%; OR 3.21, $p = 0.045$) were significant independent predictors of complications. Donor-site closure technique—open in 41 (55.4%) and primary closure in 33 (44.6%)—was not significantly associated with morbidity ($p > 0.05$).

Conclusion: Buccal mucosa graft harvesting is safe and has low donor-site morbidity and most complications are mild and short-lived. One of the risk factors is the larger graft size and diabetes, which highlights the importance of careful graft planning and preoperative optimization.

Keywords: Buccal Mucosa, Mouth Diseases, Postoperative, Urethroplasty

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Introduction

Urethral stricture disease refers to an epidemic and difficult urology disorder that involves the presence of fibrosis and constriction of urethral lumen causing obstructive voiding symptoms, frequent infections, and poor quality of life (1). The treatment to be adopted is determined by the duration, site and intensity of the stricture (2). Although such operations like dilation and

internal urethrotomy can be used with short simple strictures million segment strictures and especially those greater than 2 cm long are considered to be treated with substitution urethroplasty (3).

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Long strictures with primary anastomosis can result in chordee or sexual dysfunction and graft substitution is the most appropriate treatment (4).

Oral mucosa has proven to be the most valid and universally adopted alternative to urethral reconstruction among others compared to genital skin, extragenital skin, bladder mucosa and colonic mucosa (5). Buccal mucosa is associated with multiple benefits: it is readily obtained, has a firm and thick epithelial layer, has a well-vascularized lamina propria that promotes graft absorption, and does not show any issues with the wet urethral milieu (6). These characteristics have seen buccal mucosal grafts be the gold standard in anterior urethroplasty (7).

Though these benefits are achieved, the problem of donor site morbidity has not been left behind. Intra-oral complications have been reported, including pain, swelling, numbness, and tightness of the mouth (8), and some of the patients had reported having continued discomfort or functional impairment (9). Previously published materials typically underemphasized such complications, but the recent data shows that the symptoms of donor sites can be more common and clinically important than the previous generation of knowledge believed (10). Recognizing and measuring these complications is important to enhance the counseling of patients, the precision of the surgical technique and patient care after surgery (11).

However, data on donor site morbidity after buccal mucosal graft harvesting is scarce in Pakistan, where variations in oral health and mucosal characteristics may influence outcomes. To address this gap, the objective of this study was to determine the frequency of intra-oral donor site complications

following buccal mucosa harvesting in patients undergoing substitution urethroplasty.

Methods

It was a descriptive prospective study that was carried out at the Pakistan. The study was conducted in a 12-month period since 17 June 2022 to 16 June 2023. The calculation of the sample size was based on the single-population. proportion formula suggested by the World Health Organization (WHO) (12).

$$n = Z^2 p(1 - p)/d^2$$

A prevalence of 22% of donor-site complication was assumed considering classical. and contemporary evidence. One study gave morbidity rates of donor-sites as 20-25%. range after graft harvesting of buccal mucosa (13). Latent evidence also testifies to this at a later date. recorded eating and drinking problems postoperative in 24.1% of patients who had buccal. The same prevalence range is supported by mucosa graft harvest (14). Using a 95% confidence, 10% margin of error and taking into consideration a 10% expected post follow-ups loss. the minimum number of respondents that would have met this study was 74.

The patients aged between 18-65 years of age who had been diagnosed with anterior urethral strictures that needed substitution urethroplasty using buccal mucosa grafts were included. Patients who had a pre-existing oral pathology (lesions of the mucosa, infections, or oral ulcers), prior harvesting of the buccal mucosa, hematologic issues, uncontrolled underlying systemic disease or unwillingness to take part were excluded.

All surgeries were done by the consultant urologists per the recommendations of the European Association of Urology (EAU) Guidelines (15) on Urethral Strictures, which recommend buccal mucosa grafts as the graft

of choice in substitution urethroplasty without damaging Stensen duct. Sufficient graft size was modified based on the urethral defect. Bipolar cautery or an application of pressure attained hemostasis. The donor site was either left open to heal by secondary intention or the preferred surgeon closed the site using absorbable sutures. Antibiotics, analgesics, antiseptic mouthwash, and oral hygiene instructions were among the postoperative care. All participants were to be recorded with demographic data, stricture characteristics, graft dimensions, and surgical-related data. The evaluation of the donor-site was done at the time of hospitalization and days 7, 1 month, 3 months, and 6 months after surgery.

The primary outcome was the rate of donor-site complications, which was assessed in a clinical manner without the use of a formal pain scale. Some of the complications were postoperative pain (qualitative description), oral bleeding, edema or swelling, infection or discharge, inability to open the mouth, mucosal tightness/contracture, numbness/altered sensation, inability to chew or speak, and salivary duct injury. All the events were considered categorical variables and the length of time was registered in days or weeks.

The second outcome was functional opening of the mouth which was objectively assessed through inter-incisal distance (IID) by a sterile ruler at every follow-up. Alteration of IID with time was followed in order to assess functional restriction related to harvesting the buccal mucosa.

Data were analyzed using SPSS version 25. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as mean $\pm$ standard deviation. Associations between donor site complications and factors such as graft size, donor site closure technique, and patient

demographics were evaluated using Chi-square test or Fisher's exact test where appropriate. To control for potential confounding factors, multivariate logistic regression analysis was performed to identify independent predictors of donor site complications. A p-value <0.05 was considered statistically significant.

The Institutional Review Board of the Sindh Institute of Urology and Transplantation (SIUT) gave ethical approval to this study via letter no SIUT-ERC-2021/A-324 dated 13 December 2021. All the participants were informed with written consent before they were included in the study.

Result

A total of 74 patients were included in the study, all of whom were male 74 (100%). The mean age was 40.3 ± 12.1 years, ranging from 18 to 65 years. 13 (17.6%) patients had diabetes and 22 (29.7%) were smokers. The baseline demographic and clinical characteristics are summarized in Table 1.

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	Value
Sample size (n)	74
Mean age (years)	40.3 ± 12.1
Age range (years)	18–65
Diabetes, n (%)	13 (17.6%)
Smokers, n (%)	22 (29.7%)
Male gender, n (%)	74 (100%)

Baseline demographic and clinical characteristics of the study population, presented as number of patients and percentage n (%), As shown in Table 2, the mean graft length was 6.5 ± 1.5 cm, with a mean width of 1.8 ± 0.4 cm, resulting in an average graft area of 11.9 ± 3.3 cm². Donor-site management included leaving the site open in 41 (55.4%) patients and primary closure in 33 (44.6%) patients. The mean inter-incisal

distance (IID) was 45.2 ± 6.0 mm preoperatively and 42.8 ± 6.8 mm at 6 months postoperatively. A paired t-test demonstrated a statistically significant reduction in IID from baseline to 6 months ($t = 3.44$, $p = 0.001$), indicating a modest but significant decrease in mouth opening over time.

Table 2: Surgical Details and Mouth Opening Measurements

Surgical Variable	Value
Mean graft length (cm)	6.5 ± 1.5
Mean graft width (cm)	1.8 ± 0.4
Mean graft area (cm ²)	11.9 ± 3.3
Donor site left open, n (%)	41 (55.4%)
Donor site primarily closed, n (%)	33 (44.6%)
Mean IID pre-op	45.2 ± 6.0

Mean IID at 6 months	42.8 ± 6.8
Paired t-test (IID change)	$t = 3.44$, $p = 0.001$

Inter-incisal distance (IID) change from baseline to 6 months was analyzed using a paired t-test ($t = 3.44$, $p = 0.001$).

As illustrated in Figure 1, the overall donor-site complication rate was 9/74 (12.2%). The most common complication was edema, occurring in 6 (8.1%) patients followed by difficulty in mouth opening in 3 (4.1%) Patients. Bleeding was observed in 2 (2.7%) patients, numbness in 2 (2.7%) patients, and chewing difficulty in 2 (2.7%) patients. Infection was reported in 1 (1.4%) patient. All complications were mild and resolved over time.

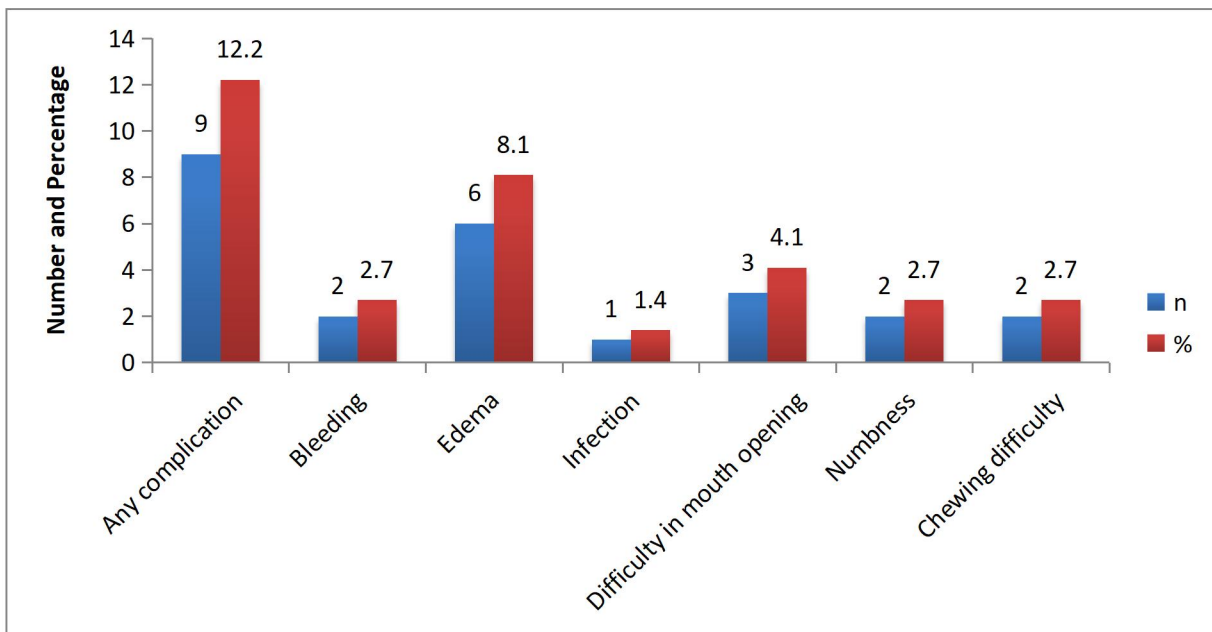


Figure 1: Donor-Site Complications, Number of patients (n) and corresponding percentages (%) of donor-site complications following buccal mucosa graft harvesting.

The mean graft area was 12.3 ± 3.5 cm² in patients with complications and 11.6 ± 3.3 cm² in those without complications, with no significant difference ($t = -1.60$, $p = 0.112$). Although the univariate independent t-test did not show a significant difference in graft area between the two groups, graft area became a

significant predictor in the multivariate logistic regression analysis ($p = 0.036$) after adjusting for confounding variables. As illustrated in Figure 2, among patients with open donor-site closure, 4/41 (9.8%) had complications, compared to 5/33 (15.2%) with primary closure. Chi-square ($\chi^2 = 0.65$, $p = 0.421$) and

Fisher's exact test ($p = 0.389$) confirmed no significant association between closure type and complications. Overall, neither graft area

nor closure method was significantly associated with donor-site morbidity.

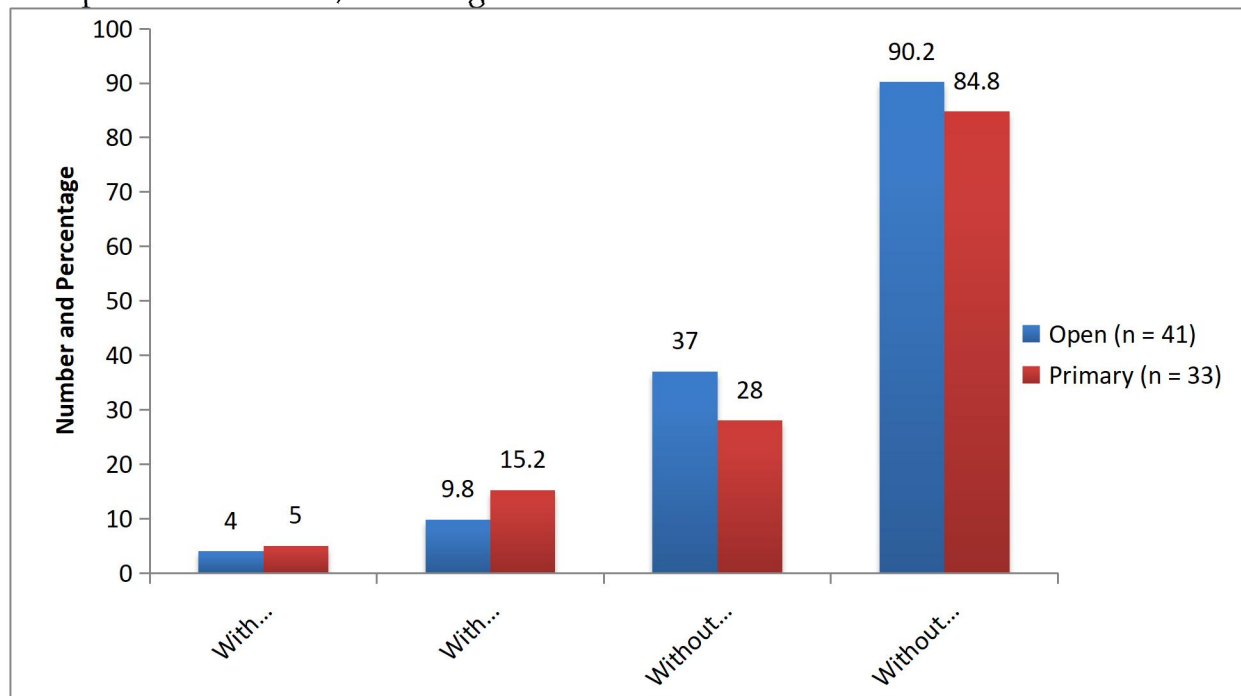


Figure 2: Comparison between Patients with and Without Donor-Site Complications

Comparison of graft area and donor-site closure type between patients with and without complications. Mean graft area was compared using an independent t-test ($t = -1.60$, $p = 0.112$), and closure type was analyzed using chi-square ($\chi^2 = 0.65$, $p = 0.421$) and Fisher's exact test ($p = 0.389$); no significant associations were observed.

Multivariate logistic regression identified independent predictors of donor-site complications. As shown in Table 3, Diabetes

significantly increased the risk of complications (coefficient = 1.167, $p = 0.045$; OR = 3.21, 95% CI: 1.03–9.92), as did larger graft area (coefficient = 0.113, $p = 0.036$; OR = 1.12, 95% CI: 1.01–1.25). Age ($p = 0.488$) and donor-site closure method (primary vs. open, $p = 0.478$) were not significant predictors. Overall, diabetes and graft area were the only significant independent predictors of donor-site morbidity.

Table 3: Multivariate Logistic Regression for Predictors of Donor-Site Complications

Variable	Coefficient	Std. Error	z-value	p-value	Odds Ratio	95% CI
Age	0.012	0.018	0.69	0.488	1.01	0.98–1.05
Diabetes	1.167	0.579	2.01	0.045	3.21	1.03–9.92
Graft area (cm ²)	0.113	0.054	2.09	0.036	1.12	1.01–1.25
Closure method (Primary)	0.366	0.518	0.71	0.478	1.44	0.55–3.76

Legend: Multivariate logistic regression of factors associated with donor-site complications. Diabetes ($p = 0.045$) and graft

area ($p = 0.036$) were significant predictors, while age ($p = 0.488$) and closure method ($p =$

0.478) were not. Coefficients, z-values, odds ratios, and 95% CIs are reported.

Mouth-opening measurements showed a greater reduction among patients who reported difficulty in opening their mouth compared to those without this complaint. As shown in Table 4, overall the mean inter-incisal distance (IID) decreased from $44.8 \pm$

6.3 mm preoperatively to 43.7 ± 6.5 mm at 6 months (mean reduction: 1.1 mm). Patients with difficulty opening ($n = 3$) demonstrated a markedly larger reduction (6.9 mm) compared with those without difficulty (0.9 mm). An independent t-test showed that this difference approached statistical significance ($t = 2.03$, $p = 0.051$).

Table 4: Mouth Opening (IID) Outcomes with Statistical Comparison

Group	IID Pre-op	IID at 6 Months	Mean Reduction	Statistical Test
Overall ($n = 74$)	44.8 ± 6.3	43.7 ± 6.5	1.1	
With difficulty opening ($n = 3$)	47.8 ± 3.1	40.9 ± 5.0	6.9	$t = 2.03$, $p = 0.051$
Without difficulty opening ($n = 71$)	44.7 ± 6.4	43.8 ± 6.6	0.9	

Legend: IID reduction was greater in patients reporting mouth-opening difficulty; independent t-test indicated the difference was borderline significant ($t = 2.03$, $p = 0.051$).

Discussion

In this study, the overall rate of complication at the donor-site after graft harvesting of buccal mucosa was low (12.2%) with edema and temporary inability to open the mouth being most common. There was a relative reduction in mouth opening, although patients who acquired functional limitation exhibited a significantly greater decrease, suggesting that trismus is clinically manifest in a minority. The independent predictors of the morbidity of the donor-site were diabetes and larger graft area, which may indicate that comorbidity of the patient and the size of the graft matter the postoperative outcome.

The complication rate in our cohort is also within the same range as the existing literature reports that indicate that harvesting of buccal mucosa is a relatively safe procedure with minimal morbidity in the long run (16). In the published literature, there are usually low incidences of bleeding,

infection, and lasting sensory changes and the same trend was observed in our results (17)(11). The results of the observed correlation between the size of the graft and morbidity increase also mirror trends of previous clinical studies (18).

Other sources also confirm the fact that the majority of the postoperative oral symptoms including swelling, eating discomfort, or temporary restriction in the opening of the mouth are likely to disappear in a few weeks to months (19). Comparison of closure and non-closure studies show mixed inconsistent differences, which is in line with our findings showing that there is no significant difference between the differences in risk of complication depending on the type of closure (20). In general, our results are consistent with the existing literature and support the idea that buccal mucosa grafting is a valid and safe method (7).

Limitations

There are certain limitations of this study. The small sample of donor-site complications might be a weakness of statistical power and the single-center design might decrease

generalizability. Clinical evaluation of the donor-site symptoms was done without standardized pain scales, and only six-month follow-ups were done, which may exclude late sequelae.

Future Suggestions

Future researchers need to involve bigger multicenter cohorts, oral morbidity measurements, randomization of the method of closure, formal mouth-opening exercises after the surgery and a longer follow-up period to identify those complications which may be persistent or delayed.

Conclusion

This study showed that buccal mucosa graft collection is in general, safe and the overall percentage of donor site complications is low. The majority of problems that occurred after the surgery was mild, temporary, and did not result in permanent functional disability. Diabetes and bigger graft area have been found to be influential predictors of high donor-site morbidity. This was accompanied by very little overall reduction in mouth opening, and restriction in a small group of patients. These results confirm buccal mucosa as a good graft option and have underscored patient optimization and graft size reduction to reduce complications.

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All the authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed.	