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Impact of urethral reconstruction length on erectile and ejaculatory function

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Abstract

Background: Urethral stricture is a prevalent urological condition with significant functional consequences. Urethroplasty remains the gold standard treatment; however, its potential effects on postoperative erectile and ejaculatory function remain a subject of debate. This study aimed to investigate whether urethral reconstruction length influences sexual outcomes in men undergoing non-transecting buccal mucosal graft urethroplasty. **Methods**: In this hybrid study with retrospective baseline data collection and prospective follow-up, 72 men aged 18–75 years who underwent urethroplasty were included. Patients were categorized into short-segment (SS; $\leq$3 cm, n = 25) and long-segment (LS; $>$3 cm, n = 47) groups. Erectile and ejaculatory functions were evaluated preoperatively and at least 6 months postoperatively using the International Index of Erectile Function (IIEF-15) and the Male Sexual Health Questionnaire-Ejaculatory Dysfunction (MSHQ-EjD). Demographic variables, urethral stricture characteristics, and surgical parameters were compared between groups. Statistical analyses included *t*-tests, Mann-Whitney U tests, chi-square tests, and correlation analyses ($p < 0.05$ considered significant). **Results**: Baseline demographics, urethral stricture location-length, and graft placement techniques were comparable between SS and LS groups. Pre- and postoperative IIEF total scores, orgasmic function, sexual satisfaction, and MSHQ-EjD scores showed no statistically significant differences between groups. Although LS patients exhibited slightly lower preoperative erectile and ejaculatory scores, postoperative outcomes and pre-to-postoperative changes did not differ significantly. No cases of *de novo* erectile dysfunction were observed. **Conclusions**: Our findings suggest that urethral reconstruction length may not significantly impact postoperative erectile or ejaculatory function in patients undergoing non-transecting buccal mucosal graft urethroplasty. Urethral stricture length alone should not be considered a determinant of postoperative sexual dysfunction. Larger, multicenter and prospective studies are required to validate these results and further clarify the association between urethroplasty parameters and sexual function.

Keywords

Urethroplasty; Erectile dysfunction; Ejaculatory disorders; Urethral stricture

Impacto de la longitud de la reconstrucción uretral en la función eréctil y eyaculatoria

Resumen

Antecedentes: La estenosis uretral es una condición urológica frecuente con consecuencias funcionales significativas. La uretroplastia continúa siendo el tratamiento de referencia; sin embargo, sus posibles efectos sobre la función eréctil y eyaculatoria posoperatoria siguen siendo motivo de debate. El objetivo de este estudio fue determinar si la longitud de la reconstrucción uretral influye en los resultados sexuales de los pacientes sometidos a uretroplastia con injerto de mucosa bucal mediante técnica no transectiva. **Métodos**: En este estudio retrospectivo con seguimiento prospectivo, se incluyeron 72 varones de entre 18 y 75 años sometidos a uretroplastia. Los pacientes se clasificaron en dos grupos según la longitud del segmento estenótico: segmento corto (SC; $\leq$3 cm, n = 25) y segmento largo (SL; $>$3 cm, n = 47). La función eréctil y eyaculatoria se evaluó en el período preoperatorio y al menos 6 meses después de la cirugía mediante el Índice Internacional de Función Eréctil (IIEF-15) y el Cuestionario de Salud Sexual Masculina: Disfunción Eyaculatoria (MSHQ-EjD). Se compararon variables demográficas, características de la estenosis y parámetros quirúrgicos entre ambos grupos. El análisis estadístico incluyó pruebas *t*, U de Mann-Whitney, chi-cuadrado y análisis de correlación ($p < 0.05$ considerado significativo). **Resultados**: Las características basales, la localización y longitud de la estenosis, así como las técnicas de colocación del injerto, fueron comparables entre los grupos SC y SL. Las puntuaciones pre y posoperatorias del IIEF (total), función orgásmica, satisfacción sexual y MSHQ-EjD no mostraron diferencias estadísticamente significativas entre los grupos. Aunque los pacientes del grupo SL presentaron puntuaciones preoperatorias ligeramente inferiores, los resultados posoperatorios y los cambios pre-posoperatorios no difirieron significativamente. No se observaron casos de disfunción eréctil *de novo*. **Conclusiones**: Los resultados sugieren que la longitud de la reconstrucción uretral no tiene un impacto significativo sobre la función eréctil ni eyaculatoria tras una uretroplastia con injerto de mucosa bucal mediante técnica no transectiva. La longitud del segmento estenótico, por sí sola, no debería considerarse un determinante de disfunción sexual posoperatoria. Se requieren estudios prospectivos multicéntricos y con mayor tamaño muestral para confirmar estos hallazgos y clarificar la relación entre los parámetros de la uretroplastia y la función sexual.

Palabras Clave

Uretroplastia; Disfunción eréctil; Trastornos eyaculatorios; Estenosis uretral

1. Introduction

Urethral stricture is characterized by narrowing of the urethral lumen due to scar tissue formation within the spongy erectile tissue of the corpus spongiosum. The fibrotic process typically begins with subepithelial inflammation and hemorrhage, followed by subsequent sclerosis and fibrosis. The etiology of urethral stricture is multifactorial, most commonly associated with iatrogenic factors such as catheterization and endoscopic interventions, as well as trauma, infections, prostatectomy, prostate cancer treatments, lichen sclerosus, or idiopathic causes [1]. Posterior urethral strictures, in particular, frequently result from pelvic fractures. Urethral stricture accounts for approximately 2% of all urological pathologies and more than 50% of urethral diseases [2], with an estimated incidence ranging from 229 to 627 per 100,000 men [3]. The current gold standard treatment is urethroplasty, which demonstrates superior success rates compared to endoscopic management, thereby making it the preferred approach [4]. While early reports on urethral reconstruction primarily focused on recurrence rates, lower urinary tract symptoms, and stricture-related complications, more recent studies have increasingly investigated postoperative sexual dysfunction as an important clinical outcome [2].

The etiology of erectile dysfunction (ED) following urethroplasty is multifactorial, involving both neurovascular and psychological factors. The cavernous nerves course lateral to the membranous urethra and may be damaged during dissection, trauma, or electrocauterization, resulting in postoperative ED [5–7]. Injury to the perineal nerves may also occur during dissection of the bulbospongiosus muscle, impairing supportive erectile innervation and thereby negatively affecting erectile function [8, 9]. In addition, injury to the bulbar or perforating arteries can impair penile blood flow, leading to vascular ED [5, 10]. Beyond physical damage, the psychological impact of surgery should also be considered. Coursey *et al*. [11] reported postoperative ED rates of 27.3% after circumcision and 30.9% after urethroplasty, with no significant difference between the two, suggesting a potential role of psychological factors in the pathogenesis of ED [12, 13].

In the meta-analysis conducted by Oszczudlowski *et al*. [14] non-transecting urethroplasty was found to be associated with a lower rate of sexual dysfunction. These findings initiated debate in the literature regarding the mechanisms and risk factors underlying ED after urethroplasty. However, studies assessing the influence of variables such as the type of repair, stricture location, and stricture length on erectile and ejaculatory function remain limited. Based on this gap in the literature, the present study aimed to investigate the impact of the length of the resected urethral stricture segment on postoperative erectile and ejaculatory functions.

2. Materials and methods

2.1 Study design and patient selection

The study was designed as a retrospective study with prospective follow-up. Initial patient enrollment and baseline data were obtained retrospectively from medical records, whereas postoperative assessments were conducted prospectively. Ethical approval was obtained from the Ethics Committee of Ankara Etlik City Hospital (Approval No: AEŞH-BADEK2-2025-469; Approval Date: 19 August 2025) and written informed consent was obtained from all participants. Male patients aged 18–75 years who underwent urethroplasty were invited for follow-up and enrolled in the study. Urethral stricture etiologies were categorized as iatrogenic, traumatic, idiopathic, and infectious-inflammatory.

2.2 Inclusion criteria

All urethroplasties were performed at a single institution by reconstructive urologists with extensive experience, each having performed more than 100 urethroplasty procedures, as recommended in previous reports [15, 16]. The patients undergoing urethroplasty for bulbar or penile urethral strictures were eligible. All procedures were performed using non-transecting techniques in which dorsal or ventral onlay buccal mucosal grafts were placed. The dissection area at the bulbar urethra level was kept as limited as possible, and electrocautery was avoided. Only patients were eligible if at least six months had elapsed since their urethroplasty.

2.3 Exclusion criteria

The patients younger than 18 years, those with very poor erectile function (International Index of Erectile Function-IIEF score $\leq$5) or no erectile function, and those whose urethroplasty was performed less than six months prior were excluded. The patients with uncontrolled chronic diseases, a history of intensive care unit admission due to coronary artery disease, spinal cord injury or surgery affecting ejaculatory function were also excluded. To ensure group standardization, patients who had undergone excision and primary anastomosis, double-face urethroplasty, peno-bulbar, or pan-urethral stricture repairs were excluded. Transecting urethroplasties were also excluded due to their higher risk of postoperative ED via cavernous and perineal nerve injury.

A total of 85 patients who underwent non-transecting urethroplasty at our institution met the inclusion criteria. Thirteen patients declined to complete the survey and were excluded, leaving 72 male patients for analysis. Based on the length of the reconstructed urethral segment, the patients were stratified into two groups: short-segment (SS) strictures ($\leq$3 cm, n_1 = 25) and long-segment (LS) strictures (>3 cm, n_2 = 47).

2.4 Preoperative assessment

Preoperative clinical records including medical history, physical examination, urinalysis and culture, uroflowmetry, and retrograde urethrography were reviewed to determine the location and length of the urethral stricture. The surgical technique was verified for consistency with the study standards. Preoperative erectile function was evaluated using the 15-item International Index of Erectile Function (IIEF) questionnaire. Erectile function (questions 1–5 and 15), orgasmic function (questions 9–10), and overall satisfaction (questions 13–14) were scored. Preoperative ejaculatory function was assessed with the Male Sexual Health Questionnaire–Ejaculatory Dysfunction (MSHQ-EjD) short form, a validated four-item instrument developed by Rosen *et al*. [17] in 2007, which evaluates ejaculation frequency, control, satisfaction, and discomfort during ejaculation.

2.5 Postoperative assessment

Erectile and ejaculatory functions reflecting the current status at least six months after urethroplasty were reassessed using the IIEF and MSHQ-EjD questionnaires. ED was defined based on the erectile function (EF) domain of the IIEF, using a cutoff value of <26. *De novo* ED was defined as a postoperative IIEF-EF score <26 in the patients who had a preoperative IIEF-EF score $\geq$26.

2.6 Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 22 (IBM Corp., Armonk, NY, USA). The Shapiro-Wilk test was applied to assess whether the parameters followed a normal distribution. Descriptive statistics were expressed as mean $\pm$ standard deviation (SD), frequency, and percentage, as appropriate.

For between-group comparisons, the Student's *t*-test was used for normally distributed variables, whereas the Mann-Whitney U test was employed for non-normally distributed variables. For within-group comparisons, the Paired Samples *t*-test was applied to normally distributed quantitative data, and the Wilcoxon Signed-Rank test was used for non-normally distributed parameters. The Kruskal-Wallis test was used for comparisons involving more than two groups when parameters did not show normal distribution. Categorical variables were compared using the Chi-square test. A p-value < 0.05 was considered statistically significant.

A priori power analysis was performed using G*Power (Version 3.1.9.7; Heinrich-Heine-University, Düsseldorf, NRW, Germany). Based on an independent-samples *t*-test with a significance level of $\alpha = 0.05$, a desired power $(1 - \beta)$ of 0.90, and a medium effect size ($d = 0.5$), the minimum required sample size was calculated as 86 (for two groups combined). The current sample size ($n_1 = 25$, $n_2 = 47$; total n = 72) provided approximately 80% power, which was deemed acceptable. Similarly, for the Chi-square test ($\alpha = 0.05$, $1 - \beta = 0.90$, $w = 0.3$), the existing sample size was determined to have sufficient power ($\approx$80%) to detect a medium effect size.

3. Results

The mean ages of the two groups were comparable (52.41 $\pm$ 14.24 *vs.* 54.94 $\pm$ 15.22 years; $p = 0.21$). The mean stricture length was 2.45 $\pm$ 1.22 cm in the SS group and 5.08 $\pm$ 2.05 cm in the LS group. The mean follow-up time from surgery to questionnaire completion was 25.8 months (range: 6–42). Given the sample size and the limited number of events, the results were primarily based on univariate analyses, and no multivariate regression model was constructed.

In the subgroup analysis based on the anatomical location of the stricture, 14 patients in the SS group and 28 in the LS group had bulbar strictures, while 11 and 19 patients had penile strictures, respectively. In both groups, the majority of strictures were localized to the bulbar urethra. The distribution did not differ significantly between the groups (Chi-square test, $p = 0.54$).

In the SS group, among a total of 25 patients, stricture etiologies were iatrogenic in 15 (60%), traumatic in 5 (20%), idiopathic in 4 (16%), and infectious in 1 (4%). In the LS group, among a total of 47 patients, 23 (48.9%) were iatrogenic, 13 (27.7%) traumatic, 5 (10.6%) idiopathic, and 6 (12.8%) infectious in origin. Chi-square analysis demonstrated that there was no statistically significant difference in urethral stricture etiologies between the SS and LS groups ($p = 0.49$).

Regarding graft placement, 18 patients in the SS group and 35 patients in the LS group underwent dorsal onlay grafting, whereas 7 and 12 patients, respectively, underwent ventral onlay grafting. Although the dorsal onlay technique was more frequently preferred in both groups, no statistically significant difference was observed between the groups ($p = 0.37$) (Table 1).

When evaluating sexual function parameters, the mean preoperative IIEF score was 18.38 ± 5.93 in the SS group and 16.69 ± 5.97 in the LS group ($p = 0.09$). Postoperative IIEF scores were 17.43 ± 6.05 and 15.93 ± 6.14, respectively ($p = 0.13$). The mean change in IIEF scores did not significantly differ between the groups (0.90 ± 0.81 *vs.* 0.65 ± 0.77; $p = 0.60$).

Preoperative sexual satisfaction scores were 8.40 ± 1.92 in the SS group and 7.98 ± 1.85 in the LS group ($p = 0.51$). Postoperative scores were 7.97 ± 1.81 and 7.72 ± 1.77, respectively ($p = 0.49$). Changes in sexual satisfaction scores were not statistically significant in either group ($p = 0.28$).

Orgasmic function scores were 6.92 ± 1.44 preoperatively and 6.61 ± 1.02 postoperatively in the SS group, compared with 6.64 ± 1.28 and 6.21 ± 1.21 in the LS group. No significant differences were observed between the groups at baseline or follow-up (preoperative $p = 0.48$; postoperative $p = 0.37$). The mean pre- to postoperative change was also not significant (0.31 ± 0.25 *vs.* 0.55 ± 0.37; $p = 0.61$) (Table 2).

Preoperatively, ejaculatory function scores were 9.4 ± 3.1 in the SS group and 7.9 ± 3.2 in the LS group ($p = 0.19$); postoperatively, the corresponding scores were 11.7 ± 5.8 and 10.9 ± 3.1, respectively ($p = 0.34$). The mean changes from baseline were not statistically different between the groups (2.3 ± 3.0 *vs.* 3.0 ± 4.8; $p = 0.69$) (Table 2).

4. Discussion

When the patients were stratified into SS and LS stricture groups based on the length of the reconstructed urethral segment, no statistically significant differences were observed between the groups in terms of age, stricture location, etiology, or graft placement (dorsal *vs.* ventral)—parameters that could potentially influence erectile or ejaculatory function. Similarly, IIEF scores, sexual satisfaction, and orgasmic function parameters were comparable between the groups, allowing them to be considered demographically and functionally equivalent. The absence of significant differences in postoperative outcomes, as well as in the preoperative-to-postoperative changes between the groups, suggests that the length of the reconstructed urethral stricture segment is not associated with the development of *de novo* erectile dysfunction following urethroplasty.

Although the patients in the LS group exhibited lower ejaculatory function scores prior to urethroplasty, no statistically significant differences were found between the groups when comparing preoperative and postoperative values or the changes between them. Improvements in ejaculatory function were observed at similar rates in both the SS and LS groups. In our study, the length of the urethral stricture segment was compared; however, the degree of luminal narrowing was not assessed between the groups. This limitation may account for the absence of statistically significant differences in ejaculatory outcomes across the two groups.

Multiple factors may influence the incidence of ED in patients undergoing urethroplasty, including preoperative erectile function, the etiology of the stricture, its length, anatomical location, and the degree of luminal narrowing. The true incidence of ED following urethroplasty remains unclear, as only a limited number of studies have investigated this issue. Most available data derive from studies comparing pre- and postoperative ED rates in patients undergoing anterior urethroplasty. Erickson *et al.* [18] reported that 44% of patients who underwent urethroplasty already had some degree of ED preoperatively. In our study, although the LS stricture group

TABLE 1. Baseline demographic and clinical characteristics of the patients with short-segment and long-segment stricture groups.

	Short-segment strictures (≤3 cm, $n_1 = 25$) Mean ± SD	Long-segment strictures (>3 cm, $n_2 = 47$) Mean ± SD	*p*-value
Age, yr	52.41 ± 14.24 (21–75)	54.94 ± 15.22 (19–75)	0.21
Length of stenotic segment, cm	2.45 ± 1.22 (1–3)	5.08 ± 2.05 (4–11)	<0.001
Penile/Bulbar urethral stricture location, n	11/14	19/28	0.54
Dorsal/Ventral graft placement, n	18/7	35/12	0.37

SD: standard deviation; n: number of the patients.

TABLE 2. Comparison of preoperative and postoperative sexual function outcomes between short-segment and long-segment stricture groups.

	Short-segment strictures (≤3 cm, $n_1 = 25$) Mean ± SD	Long-segment strictures (>3 cm, $n_2 = 47$) Mean ± SD	*p*-value
Preoperative IIEF	18.38 ± 5.93	16.69 ± 5.97	0.09
Postoperative IIEF	17.43 ± 6.05	15.93 ± 6.14	0.13
Pre- to Postoperative Change in IIEF	0.90 ± 0.81	0.65 ± 0.77	0.60
Preoperative Sexual Satisfaction	8.40 ± 1.92	7.98 ± 1.85	0.51
Postoperative Sexual Satisfaction	7.97 ± 1.81	7.72 ± 1.77	0.49
Pre- to Postoperative Change in Sexual Satisfaction	0.53 ± 0.55	0.31 ± 0.51	0.28
Preoperative Orgasmic Function	6.92 ± 1.44	6.64 ± 1.28	0.48
Postoperative Orgasmic Function	6.61 ± 1.02	6.21 ± 1.21	0.37
Pre- to Postoperative Change in Orgasmic Function	0.31 ± 0.25	0.55 ± 0.37	0.61
Preoperative Ejaculatory Function (MSHQ-EjD)	9.4 ± 3.1	7.9 ± 3.2	0.19
Postoperative Ejaculatory Function (MSHQ-EjD)	11.7 ± 5.8	10.9 ± 3.1	0.34
Pre- to Postoperative Change in Ejaculatory Function (MSHQ-EjD)	2.3 ± 3.0	3.0 ± 4.8	0.69

IIEF: International Index of Erectile Function; MSHQ-EjD: Male Sexual Health Questionnaire–Ejaculatory Dysfunction; SD: standard deviation; n: number of the patients.

demonstrated lower preoperative IIEF scores, this difference was not statistically significant when compared to the SS stricture group.

In urethroplasty, age-just as much as the length of the operated strictured segment-is an important factor in the recovery of postoperative erectile function impairment. In a study conducted by Bhowmik *et al.* [19], although a correlation was found between the length of the strictured segment and ED, age was also identified as an important factor in early recovery. It was observed that most young patients had recovered completely within six months.

Previous studies have suggested that elderly patients and those with longer stricture segments (6.8 cm *vs.* 4.4 cm) have a higher incidence of *de novo* ED following urethroplasty [11]. However, subsequent studies have reported conflicting results. A meta-analysis evaluating 36 studies with a total of 2323 patients demonstrated no significant association between stricture length and the incidence of postoperative ED [20]. This meta-analysis also noted that *de novo* ED is uncommon, occurring in only 1% of cases. When examining studies that assessed erectile function at different postoperative intervals, the majority of ED cases were found to be transient, with recovery observed in approximately 86% of the patients between 6 and 12 months after urethroplasty. In our study, the absence of *de novo* ED in both groups, together with the similarity in pre- and postoperative ED rates, may be attributed to the relatively long mean follow-up period of 25.8 months, during which transient impairments in erectile function would likely have resolved.

Consequently, early postoperative erectile function impairments observed in some patients may have resolved by the time of assessment, potentially leading to an underestimation of transient postoperative ED. Future studies with standardized and multiple postoperative assessment time points are needed to more accurately characterize the temporal course of sexual function recovery after urethroplasty.

In a study conducted by Urkmez *et al.* [8] investigating the relationship between urethroplasty and erectile dysfunction, the patients with urethral stricture segments measuring 1–3 cm had significantly higher mean preoperative scores for IIEF, sexual satisfaction, and orgasmic function compared to those with stricture segments of 4–7 cm. Although this finding appears to challenge the homogeneity of the groups, no statistically significant differences were observed between the short- and long-segment stricture groups with respect to postoperative IIEF, sexual satisfaction, or mean orgasmic function scores. Similarly, in our study, although preoperative IIEF scores were somewhat lower in the LS stricture group, no statistically significant differences were found between the groups. Therefore, we considered the SS and LS stricture groups to be comparable in our analysis.

The fact that urethroplasty procedures were performed by multiple surgeons and the relatively small sample size com-

pared with other studies in the literature represent important limitations of this study. Therefore, the observed associations should be interpreted as exploratory rather than definitive, and potential confounding effects of age, comorbidities, smoking status or stricture characteristics could not be fully adjusted for. Furthermore, the lack of assessment of the degree of urethral luminal narrowing resulted in limited data diversity and prevented subgroup analyses, which may further reduce the generalizability of our findings.

Another limitation is that the final sample size did not reach the number estimated by the a priori power analysis. This may have limited our ability to detect small to moderate differences between the groups and increased the risk of a type II error.

5. Conclusions

In this study, we found that the length of the urethral stricture segment subjected to urethroplasty had no significant effect on erectile, ejaculatory functions or sexual satisfaction. In both short and long segment stricture groups, no marked deterioration in sexual function was observed in the postoperative period, and no cases of *de novo* erectile dysfunction were detected. Our findings suggest that preoperative stricture length alone is not a determinant of postoperative sexual function and that most sexual dysfunctions observed after urethroplasty are likely transient. Larger, prospective studies with standardized surgical techniques are required to further clarify the relationship between urethroplasty and sexual function.

AVAILABILITY OF DATA AND MATERIALS

The datasets used during the current study are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

EH and İEE—designed and performed the research study; wrote the manuscript. EK and HS—collected and analyzed the data. FY—reviewed the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study has obtained the written informed consent of all participants and was conducted in accordance with the ethical principles of medical research involving human subjects in the Helsinki Declaration. It has been approved by The Ethics Committee of Ankara Etlik City Hospital (Approval No: AEŞH-BADEK2-2025-469. Approval Date: 19 August 2025).

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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