

Frenulum Protection Technique in Disposable Circumcision Suture Device for Adult Males

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Purpose: To evaluate the efficacy of frenulum protection technique of the disposable circumcision suture device (DCSD) in adult males.

Materials and Methods: A total of 53 adult males were diagnosed with redundant prepuce and underwent circumcision with DCSD using frenulum protection technique. The main preoperative and postoperative measure of the length of penile frenulum was evaluated. Other data such as edema rate, intraoperative blood loss, operation time, postoperative pain, staple falling off time, incision infection rate, and evaluation of satisfaction rate with penis appearance were documented in the study.

Results: There was no significant difference in preoperative and postoperative frenulum length for each patient. The mean length of the penile frenulum before and after surgery was 2.25 ± 0.36 cm and 2.23 ± 0.39 cm, respectively ($p = .31$). The rate of frenulum length preservation was 100%. All the patients had no excessive resection of the frenulum and no serious complication happened after surgery. The satisfaction rate of postoperative penis appearance from patients' evaluation was 98.1% (52/53).

Conclusion: The frenulum protection technique was simple and operable, which could help the operator to accurately identify the most distal position of the frenulum and retain a sufficient length of frenulum during DCSD circumcision.

Keywords: short frenulum; circumcision; disposable circumcision suture device; frenulum protection technique

INTRODUCTION

Circumcision is a very common surgical procedure for redundant prepuce and phimosis.^(1,2) This operation improves the hygiene of the glans and coronal sulcus, reducing the risk for HIV, some sexually transmitted infections, and penile cancer.^(3,4,5) Recently, disposable circumcision suture device (DCSD) has been increasingly used in circumcision, due to shorter operation time and better security.^(6,7) However, compared with traditional manual circumcision, the disadvantage of DCSD is that the internal condition of the inner plate of prepuce and penile frenulum can not be observed from outside when bell-shaped glans pedestal is placed (**Figure 1A**), which may result in excessive resection of the frenulum. In clinic, some patients even complained that the frenulum was short after the operation. A majority of previous reports of DCSD-related adverse events mainly focused on bleeding, edema, haematoma, and wound healing,^(8,9) but the

length of the reserved frenulum was rarely paid attention to. The shortness of prepuce frenulum not only causes painful tight erection, downward curvature of the glans, and recurrent coital injuries,⁽¹⁰⁻¹⁴⁾ but also affects the appearance of penis, causing anxiety and depression in some patients. Therefore, we introduce a technique to protect the frenulum during DCSD circumcision in this study.

MATERIALS AND METHODS

Study population

From February 2020 to July 2022, a total of 53 adult males were diagnosed with redundant prepuce and underwent circumcision with DCSD using the frenulum protection technique. The study was approved by the ethics committee of Changhai hospital (CHIC-TR2000039973), and each patient provided written consent.

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Table 1. Preoperative and postoperative frenulum data.

Variables*	Preoperative Data	Postoperative Data	Frenulum Length Preservation(%)
The Mean Length of Penile frenulum(N=53cases)	2.25 ± 0.36 cm	2.23 ± 0.39 cm	53/53(100%)
Short Frenulum Group (N=8 cases)	1.66 ± 0.13 cm	1.65 ± 0.12 cm	8/8 (100%)
Medium Frenulum Group (N=31 cases)	2.23 ± 0.19 cm	2.22 ± 0.20 cm	31/31(100%)
Long Frenulum Group (N=14 cases)	2.64 ± 0.23 cm	2.61 ± 0.25 cm	14/14(100%)

*Preoperative and postoperative frenulum data and difference-value all met normality. Frenulum length was calculated by paired-samples T test to compare preoperative and postoperative paired outcome. $r > .05$ indicated there was no statistically significant difference in preoperative and postoperative frenulum length.

Inclusion and exclusion criteria

Patients with redundant prepuce requiring circumcision were included in the study, and all the patients were older than 18 years and had no history of circumcision. Patients with phimosis or occult penis or younger than 18 years of age were excluded from this study. All operations were performed by the same operator.

Operative procedures

All the patients were required to have skin preparation. Patients were placed in the supine position. A marking line was drawn at the most distal end of the penile frenulum (**Figure 1B**), to measure the length of penile frenulum and penis circumference(**Figure 1C, D**). The operation site was given routine disinfection with iodophor. The penis was locally anesthetized with lidocaine. The appropriate DCSD was selected according to the penis circumference. The bell-shaped glans pedestal of DCSD was immersed in iodophor before using it. Frenulum protection technique: Firstly, the location of

the frenulum is marked by a marker pen. Then three hemostatic forceps were used to pull the frenulum to observe the frenulum marking line (**Figure 2A**). Two separate 5-0 absorbable silk sutures were set for 'in-out' suture placement (**Figure 2B**). Then, the suture at the marking line site could denote the inside location of the most distal end of the frenulum from the outside (**Figure 2C**). The bell-shaped glans pedestal was placed and the pedestal side adjacent to the frenulum was adjusted beyond the suture marker (**Figure 2D**). The marker sutures were slightly pulled while the circumcision was performed as following. With the knob tightened and the safe buckle on the handler removed, the handler was squeezed and held to trigger the circumcision device for 30 seconds. Then the marking sutures were removed before releasing the handler and quitting the bell-shaped glans pedestal (**Figure 2E**).

Finally, the operator checked the wound situation (**Figure 2F**). The self-adhesive elastic bandages with pres-

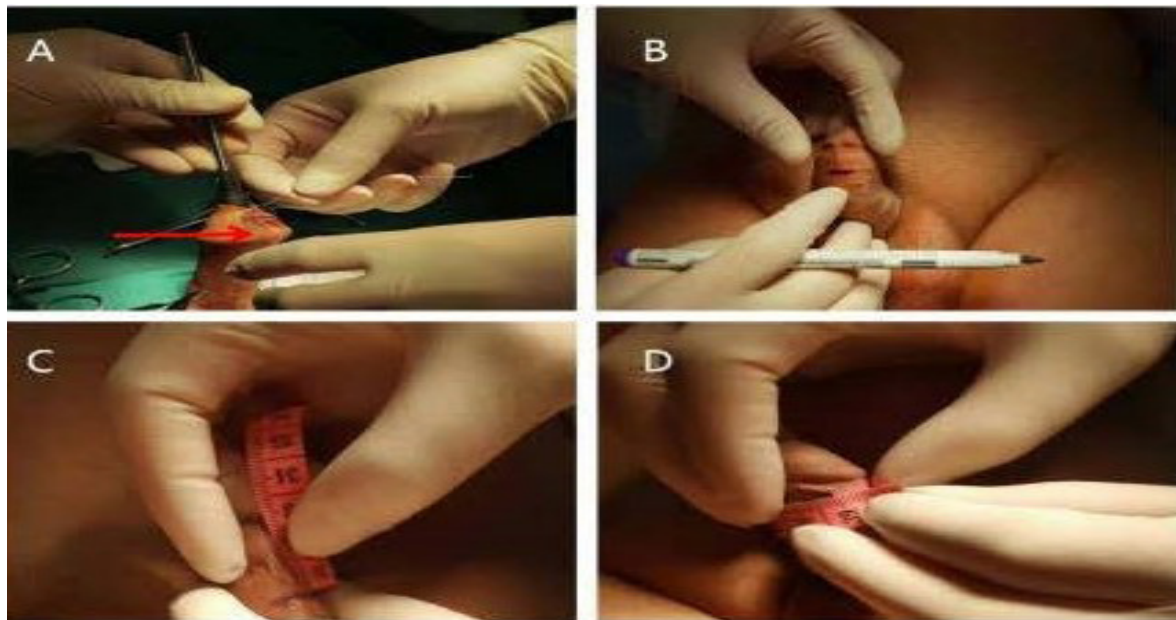


Figure 1: (A) when bell-shaped glans pedestal was placed and the foreskin mouth was tightened, the Internal situation of the inner plate of prepuce and penile frenulum could not be observed from outside, which was indicated by red arrow. (B) A marking line was drawn by marker to locate the most distal end of the penile frenulum. The marking line could be located on the a little more proximalordistal position according to the the length of prepuce frenulum. (C) The length of penile frenulum was about 1.5 cm. (D) The circumference of penile was was about 8cm.

Table 2. Intraoperative and postoperative clinic data.

The Mean Operative time(min)	7.0 ± 1.3
Intraoperative Bleeding(mL)	3.5 ± 0.9
Edema Rate (%)	47.2%(25/53)
Median Pain Score(points)	2

Table 3. The data of complications after circumcision

Group	Data
Wound Dehiscence rate(%)	1.8%(1/53)
Infection Rate(%)	0%(0/53)
Residual Staples Rate (%)	17%(9/53)
Satisfaction(%)	98.1%(52/53)

sure were dressed to the incision, which was changed on the 4th day and 1 week after operation. The length of postoperative prepuce frenulum and penis circumference was measured on the 7th day after operation. The staples always began to fall off spontaneously about 9 days postoperatively. If the staples were still retained 1 month after operation, the operator would need to remove the residual staplers. If the patients had complications such as incision dehiscence and infection, they were requested to return to the inpatient ward.

The length of penile frenulum and the circumference of penis before and after surgery were recorded. They were divided into three groups according to the pe-

nile frenulum length, including the long frenulum group (>2.5 cm), medium frenulum group (1.5 ~ 2.5 cm), and short frenulum group (≤ 1.5 cm). Moreover, postoperative edema rate, blood loss, operation time, postoperative pain, staple falling off time (the time when the staples started falling off and the time when the staples finished falling off), infection rate, and evaluation of satisfaction rate with penis appearance were recorded in the study.

Evaluations

The rate of frenulum length reservation was judged as below: the marking line was still reserved with the frenulum after incision and the marking sutures could

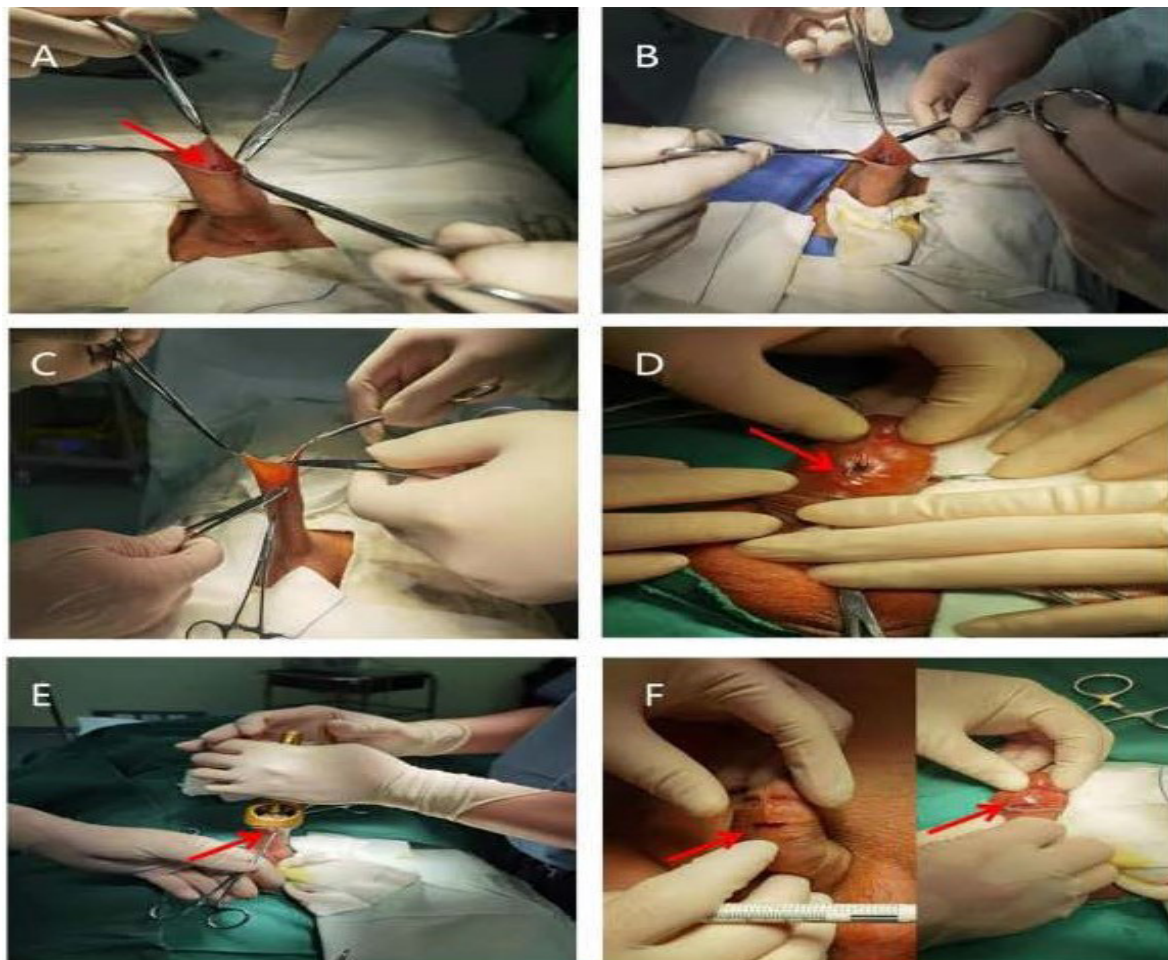


Figure 2: (A) Raised prepuce by three hemostatic forceps, and observed the marking line of the most distal position of frenulum, indicated by the red arrow.-(B & C) ‘in-out’ suture placement: silk thread passed through the inner and outer plates in turn on the site of marking line. (D) Red arrow showed suture marking replaced marking line. (E). Red arrow showed the most distal end of penile frenulum by suture marking. The frenulum would not be excessively removed, when tightened the knob was tightened and the edge of bell-shaped glans pedestal did not beyond the suture marking. (F) After the procedure, the marking line was still visible, which meant the frenulum was well preserved.

be removed freely when circumcision was performed. The rate of postoperative edema was judged by comparing the circumference of the penis before and after the operation. Pain was recorded using an internationally accepted visual analogue scale, ranging from 0- 10 points. The postoperative satisfaction evaluation was judged by each patient, categorized as very unsatisfactory, unsatisfactory, satisfactory, and very satisfactory. The satisfaction rate included satisfactory and very satisfactory.

Statistical Analysis

Based on a preliminary trial we found the length of penile frenulum before surgery was 2.3cm and the length of the penile frenulum after surgery was no less than 2.2cm. Setting a power of 80% and an alpha of 0.05, the minimum sample size was calculated to be 50 cases. Statistical analysis software SPSS 27 was utilized for statistical analysis. Numerical Data were presented as mean \pm standard deviation, median (Inter-quartile range, IQR). Categorical variables were presented as frequency and percentage. Paired *t*-test assumes that differences between pairs should be approximately normally distributed, otherwise Wilcoxon rank-sum test was performed. Normality of preoperative, postoperative frenulum data and difference-value were assessed before paired *t*-test. $P < .05$ was considered as statistically significant difference.

RESULTS

A total of 53 adult males were diagnosed with redundant prepuce and underwent circumcision with DCSD using the frenulum protection technique. All patients finished four-week follow-up.

Of 53 patients, 14 had long frenulum length (> 2.5 cm), 31 had medium frenulum length ($2 \sim 2.5$ cm), and 8 had short frenulum lengths (< 2 cm) (Table 1).

The data conformed to a normal distribution, and the difference in preoperative and postoperative frenulum length was negligible and not statistically significant. The mean length of penile frenulum before and after surgery was 2.25 ± 0.36 cm and 2.23 ± 0.39 cm, respectively ($p = .31$) (Table 1). To further compare differences, groups were classified by length. The mean length of the short frenulum group before and after surgery was 1.66 ± 0.13 cm and 1.61 ± 0.11 cm respectively. The mean length of the medium frenulum group before and after surgery was 2.23 ± 0.19 cm and 2.22 ± 0.20 cm respectively. The mean length of the long frenulum group before and after surgery was 2.64 ± 0.23 cm and 2.61 ± 0.25 cm respectively. The rate of frenulum length preservation in each group was 100% as judged. The above data showed that there was no shortness of the frenulum after surgery and the technique could help operators to retain the frenulum with any length. The mean operative time was 7.0 ± 1.3 min (Table 2). The intraoperative bleeding was 3.5 ± 0.9 mL. The mean circumference of the penis before and after surgery (7 days postoperatively) was 8.1 ± 0.79 cm and 9.73 ± 0.94 cm, respectively ($r = .02$), which showed the foreskin edema happened after surgery. The postoperative edema rate was 47.2% (25/53) (Table 2). The median time of postoperative edema resolution was 14 days. The median postoperative (3 days postoperatively) pain score was 2 points. The median time when the staples finished falling off time was 15th day. For 9

(17%, 9/53) patients with residual staples in one month after surgery, the staplers were removed by the operator (Table 3).

One patient had local wound dehiscence in the operation (1.89%, 1/53) (Table 3), and was saved by absorbable suture and the wound healed one month later. No infection, frenulum injury or other complications happened. The satisfaction rate including satisfactory or very satisfactory of postoperative penis appearance from patients' evaluation was 98.1% (52/53) (Table 3).

DISCUSSION

Disposable circumcision suture device (DCSD) have been used clinically for about a decade (15- 18) but the injury of penile frenulum by DCSD was rarely reported. To avoid accidental injury of the frenulum, we developed a technique to protect the frenulum during DCSD. Obviously, DCSD in this study showed significant advantages such as shorter operation time, shorter postoperative recovery, safety, less pain and high satisfaction with the cosmetic appearances as previously reported.^(7,9,14-18)

In DCSD circumcision, approximately 7.5% of patients experience frenulum injury, primarily frenulum shortening.⁽¹⁹⁾ The main cause of frenulum injury was related to the blindness of the location of the frenulum during DCSD operation. Thus, our frenulum protection technique had the following advantages: 1)The technique could help the operators to accurately identify the most distal location of the frenulum and avoid excessive excision of the frenulum. 2)It was recommended to place two silk threads at the site of the frenulum marking, which can better fix the end of the frenulum and prevent injury of the frenulum. 3)The technique could help the operators to preserve any length of the frenulum, whether it was long, medium or short.

Frenulum protection technique was used to replace the marking line by suture marking. By in-out suture placement, the most distal location of the penile frenulum in the inner plate could be observed in outer plate. On the other hand, the two-suture method was stressed for frenulum preservation because this kind of suture can prevent frenulum injury from sliding, compared with single silk thread. It was recommended to remove the suture before releasing the handler. Whether the frenulum was injured could also be judged easily by how the silk thread could be removed.

Frenulum protection technique retained sufficient frenulum length, no matter what the frenulum length was. Despite the length of the frenulum was different before and after surgery, actually the frenulum length was totally preserved and no frenulum injury happened according to the standard ascribed. The difference in frenulum length before and after surgery may be related to the change in frenulum status and measurement conditions.

The staples of 9 (17%, 9/53) patients in the study did not fall off completely one month after the operation. Removing the remaining staplers will cause some pain and bleeding to the patient. Second, the dorsal inner prepuce plate might be retained too much, which could be a risk factor for premature ejaculation.⁽¹²⁾ The reason might be that preserving the length of frenulum, especially long frenulum length, would require keeping a long inner prepuce plate. The new circumcision suture device or new technique might be necessary to be de-

veloped to solve the above problems. In addition, We hoped to conduct a large-scale clinical trial in the near future to overcome the limit of such kind of before-after design with regression to the mean and time trends.

CONCLUSIONS

Our frenulum protection technique was feasible to avoid accident injury of the frenulum when performing circumcision with DCSD. Even for differential frenulum length, the technique was still effective without extra complication.

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CONFLICT ON INTEREST

The authors report no conflict of interest.

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