

# Early results with the Mutaf technique: a novel off-midline approach in pilonidal sinus surgery

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**Purpose:** The objective of the present study was to compare different off-midline techniques in terms of their advantages and disadvantages.

**Methods:** A total of 81 patients were included in this prospective, controlled, randomized study. Patients in group 1 were treated with the Limberg flap, and patients in group 2 were treated with Mutaf technique. Patients were followed up for 9 months postsurgically and assessed at regular intervals.

**Results:** A total of 41 and 40 patients received surgical treatment with Limberg or Mutaf techniques, respectively. The 2 groups were similar in terms of age, gender, body mass index, and Tezel pilonidal sinus classification. Also, the 2 groups were comparable with regard to the frequency of preoperative discharge from the wound site, history of abscess formation, and the resultant antibiotic use. Early results showed similar recurrence rates and surgical-site complications between the 2 groups. Although a lower visual analogue scale score was found in group 2 at postoperative day 1, seroma persistence, time to withdrawal of surgical drains, and wound healing were more prolonged.

**Conclusion:** In this study, Mutaf technique was comparable to Limberg flap in the treatment of pilonidal sinus. Therefore, Mutaf technique may be offered as a viable surgical therapeutic option among off-midline closure approaches.

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**Key Words:** Pilonidal sinus, Surgical Flaps, Surgical treatment

## INTRODUCTION

Pilonidal sinus (PS) is an acute, chronic, symptomatic or asymptomatic clinical condition occurring at the natal cleft in the sacrococcygeal area. Untreated subjects experience a vicious cycle consisting of the development of subcutaneous infection, abscess formation, spontaneous or surgical drainage of the abscess, and serous discharge. Therefore, although it is not a life-threatening condition, it may adversely affect the quality of life with restriction of the activities of daily living.

PS is more prevalent in the young working population, with a male to female ratio of 2.2-4 to 1 (males prevalent

is 2.2–4 times more than females). The reported incidence rate in the United States is 26/100 [1]. Surgery represents a therapeutic option for patients with PS and despite many different techniques described in the literature for the surgical treatment of this condition, no consensus has been reached regarding the best strategy. Low recurrence rates reported in recent publications for off-midline closure techniques has led to the routine recommendation of this management strategy [2]. Previously described techniques all have their pros and cons. The primary prerequisite in an ideal surgical technique involves low recurrence and surgical complication rates, as well as other attributes such as the simplicity of the technique,

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low-cost, short duration of hospital stay, quick recovery and return to daily activities, and minimum adverse cosmetic and psychological effects.

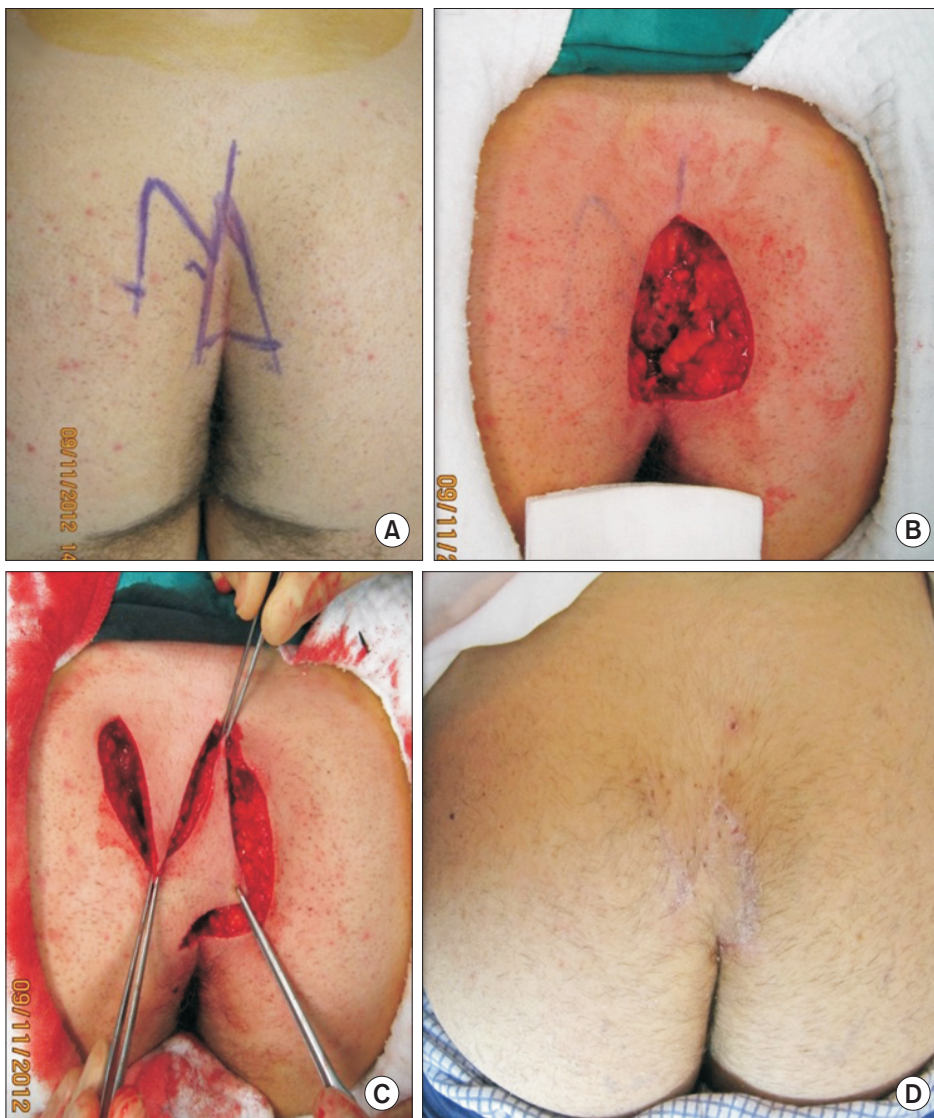
In this regard, Limberg flap technique, an off-midline closure method, has long been considered a standard surgical approach by many experts and is commonly recommended for the surgical treatment of this condition. On the other hand, the Mutaf triangle closure technique, originally described by Mutaf, was first used in patients with large myelomeningocele defects [3]. Thanks to unequal z-plasty, two different flaps can be formed that have been reported to provide better tissue relaxation, which allows both the primary closure of the donor area and better vascularization of the flap tissue and tension-free closure. [3]. Thus, in this study our aim was to compare this novel technique with Limberg flap technique.

## METHODS

This was a prospective, controlled, randomized, single-center study. The study protocol was approved by the Ethics Committee, Ankara Numune Training and Research Hospital (approval number: 20796219-724.0849). A total of 81 patients who were diagnosed with PS between 01 January 2014 and

**Table 1.** Tezel classification

Type	Tezel classification
I	Asymptomatic sinus
II	Acute pilonidal abscess
III	Chronic (symptomatic) restricted in navicular area
IV	Chronic (symptomatic) exceeded navicular area
V	Recurrent pilonidal sinus



**Fig. 1.** Mutaf triangle closure technique: (A) drawing flap, (B) excision of natal cleft, (C) preparation of flap, and (D) post-operative day 60.

31 December 2014 at Çorum Research and Training Hospital, Hitit University Medical Faculty and who met the inclusion criteria were included in this study. The study was conducted in accordance with the principles set forth in the Helsinki Declaration. All patients provided written informed consent before study participation. The randomization scheme was based on the outpatient attendance number such that those with an odd number were assigned into group 1 and those with an even number into group 2, who were treated with Limberg flap technique and Mutaf triangular defect closure technique, respectively.

### Patient selection

Female or male PS patients over 18 years of age were included and classified according to the navicular area concept proposed by Tezel [4] (Table 1).

Preoperatively age, gender, body mass index (BMI), previous treatments (discharge, antibiotics, use of antibiotics, etc.) were recorded. Also, the duration of surgery, defined as the time from initiation of incision to the placement of last skin suture, was recorded.

Postoperative follow-up controls were performed at bedside following surgery, at 30 days and at 6 months at the outpatient unit. The visual analogue scale (VAS) scores (between 0 and 10) were recorded at day 1, 10, and 30.

Surgical-site related complications including induration, wound dehiscence, seroma formation, hematoma, sensory loss at the wound site, and infections were recorded.

Duration of hospital stay was defined as the time from the termination of surgery to discharge. Healing time was defined as the duration of time from the day of surgery to the removal of stitches (or to complete healing when complications were present). The incidence of early recurrence was determined with 6 months of follow-up data.

### Technical descriptions

Patients in group 1 were operated on using Limberg flap technique according to the descriptions by Menten et al. [5], while those in group 2 were operated on using Mutaf triangular closure technique as described by Mutaf et al. [3] (Fig. 1).

In both techniques, a 12F suction drain tube was placed subcutaneously and anatomical layers were closed with 2 layers. The 2/0 absorbable polyglactin sutures were used for the subcutaneous layers, while the skin was closed using 3/0 unabsorbable polypropylene sutures with mattress stitches. Prior to surgery all patients received a single dose of 1-g cefazolin intravenously for infection prophylaxis.

No further antibiotic treatments were given postoperatively or at discharge. All surgical procedures were performed under standardized spinal anesthesia. Diclofenac intramuscular was given at postoperative hour 8 for analgesia, followed by

diclofenac oral tablets twice a day. Drains were removed when the output was below 20 mL/day. Sutures were removed at postoperative day 10.

### Statistical analyses

IBM SPSS Statistics ver. 20.0 (IBM Co., Armonk, NY, USA) was used for statistical analyses. For statistical analysis, frequency distributions according to dependent variables and descriptive statistics were obtained for both surgical techniques. For examination of the effect of surgical technique on dependent variables, chi-square and Fisher exact chi-square analyses were used for the qualitative variables, while tests of normality were performed for the quantitative analyses for the association between the surgical technique and the quantitative dependent variables. Pairwise group comparisons were carried out using the two-sample t-test and Mann-Whitney U-test depending on the normal distribution of the data. Ninety-five percent confidence intervals were provided and a P-value of less than 0.05 was considered statistically significant.

**Table 2.** Basics characteristics of patients

Variable	Limberg flap (n = 41)	Mutaf flap (n = 40)	Chi-square	P-value
Age (yr)				0.25
18–29	32 (78)	32 (80)		
≥30	9 (22)	8 (20)		
Sex			2.49	0.115
Male	33 (80.5)	37 (92.5)		
Female	8 (19.5)	3 (7.5)		
Body mass index (kg/m <sup>2</sup> )			1.81	0.405
Healthy (<25)	21 (51.2)	16 (40)		
Overweight (25–29.9)	15 (36.6)	15 (37.5)		
Obese (≥30)	5 (12.2)	9 (22.5)		
Preoperative flux			0.02	0.893
Present	17 (41.5)	16 (40)		
N/A	24 (58.5)	24 (60)		
Preoperative abscess			0.67	0.413
Present	18 (43.9)	14 (35)		
N/A	23 (56.1)	26 (65)		
Preoperative antibiotic			0.01	0.932
Present	15 (36.6)	15 (37.5)		
N/A	26 (63.4)	25 (62.5)		
Duration of symptoms (mo)				0.735 <sup>a)</sup>
Mean	26.56	25.10		
Median	12.00	18.00		
Tezel classification				
Type I	12 (29.3)	10 (20)		0.474
Type II	3 (7.3)	2 (2.5)		0.620
Type III	12 (29.3)	12 (30)		0.986
Type IV	13 (31.7)	13 (35)		0.931
Type V	1 (2.4)	3 (12.5)		0.182

Values are presented as number (%) unless otherwise indicated. N/A, absent.

<sup>a)</sup>Mann-Whitney test.

**Table 3.** Preoperative and postoperative evaluation results

Variable	Limberg group (n = 41)	Mutaf group (n = 40)	Chi-square	P-value
Operation time (min)	34.27 ± 8.0	31.60 ± 9.2		0.170
Induration				0.201 <sup>a)</sup>
N/A	40 (97.6)	36 (90.0)		
Present	1 (2.4)	4 (10.0)		
Wound separation				0.494 <sup>a)</sup>
N/A	41 (100)	39 (97.5)		
Present	0 (0)	1 (2.5)		
Seroma				0.026 <sup>a),*</sup>
N/A	41(100)	35(87.5)		
Present	0 (0)	5 (12.5)		
Hematoma				0.494 <sup>a)</sup>
N/A	41 (100)	39 (97.5)		
Present	0 (0)	1 (2.5)		
Loss of sensation			2.17	0.141
N/A	21 (51.2)	14 (35.0)		
Present	20 (48.8)	26 (65.0)		
Infection			2.76	0.096
N/A	38 (92.7)	32 (80.0)		
Present	3 (7.3)	8 (20.0)		
Follow-up time (mo)				>0.05
Mean	9.2	8.9		
Range	6–13	6–13		
Recurrence (control 6 mo)				>0.616 <sup>a)</sup>
N/A	40 (97.6)	38 (95.0)		
Present	1 (2.4)	2 (5.0)		
VAS score				0.048*
Postop day 1				
Mean	1.68	1.05		
Median	2.00	1.00		
Postop day 10				0.796
Mean	0.37	0.35		
Median	0	0		
Postop day 30				0.975
Mean	0.17	0.07		
Median	0	0		
Duration of hospitalization (day)				0.600
Mean	2.49	3.38		
Median	2.00	2.00		
Drain removal time (day)				<0.001**
Mean	4.07	9.42		
Median	0	3.00		
Healing time (day)				<0.001**
Mean	11.95	15.03		
Median	11.00	15.00		

Values are presented as mean±standard deviation or number (%) unless otherwise indicated.

N/A, absent; VAS, visual analogue scale.

<sup>a)</sup>Fisher exact test. \*P < 0.05 significant level of importance. \*\*P < 0.01 significant level of importance.

## RESULTS

The demographic data for the study subjects (n = 81) is summarized in Table 2. Groups 1 and 2 consisted of 41 and 40 patients, respectively, with an overall male-to-female ratio of 70:11. The 2 groups were comparable in terms of age, gender, BMI, and Tezel PS classification as well as preoperative history of wound site discharge, and abscess formation and related antibiotic use. The mean follow up was 9.2 and 8.97 months, respectively.

In both groups, the majority of the patients were between 18 and 29 years of age and had a BMI < 25 kg/m<sup>2</sup>. Preoperatively, the average duration of symptoms was 26.56 and 25.1 months in groups 1 and 2, respectively.

Intra- and postoperative patient data are shown in Table 3. The duration of surgery was similar across the study groups.

Rate of surgical site complications such as induration at the surgical wound, wound dehiscence, hematoma formation, and sensory loss were comparable between the 2 groups. However, significant differences were found between the 2 groups in terms of seroma formation, surgical drain removal time, and healing time.

A significant difference in favor of Mutaf technique was found with regard to VAS scores at postoperative day 1, while no difference in VAS scores were observed at postoperative days 10 and 30.

The duration of hospital stay was similar between the 2 groups, as were the rates of recurrence at 6 months post-operative.

## DISCUSSION

The word pilonidal derives from the Latin words pilus ("hair") and nidus ("nest") and PS was originally described by Andersson in 1847. It is an infectious disease arising from the hair follicles on the natal cleft in the sacrococcygeal region that may have an acute, chronic, symptomatic or asymptomatic course. It is generally considered as an acquired condition rather than a hereditary one [6]. The treatment options vary from simpler surgical approaches such as fistulotomy + curettage to those involving more advanced flap repair techniques. Defects formed after total excision of PS have been traditionally treated with primary midline repair, marsupialization, leaving the wound open, or MacFee technique. Also, off-midline techniques have been utilized for defect reconstruction such as Rhomboid excision plus Limberg flap, Karyadakis flap, Bascom (cleft lift), V-Y advancement flap, Z-plasty, elliptical rotation flap, perforator flaps, and gluteus maximus muscle-skin flaps, with certain pros and cons associated with each of these techniques. An ideal surgical technique should have low recurrence and



surgical complication rates, as well as other attributes such as the simplicity of the technique, low-cost, short duration of hospital stay, quick recovery and return to daily activities, and minimum adverse aesthetic and psychological effects.

In a 2008 meta-analysis by McCallum et al. [2] involving a number of randomized controlled studies found low recurrence rates with off-midline closure techniques, hence the authors recommended that off-midline techniques be the standard approach in the surgical treatment of patients with PS. In another meta-analysis by Horwood et al. [7] in 2012, only 8 studies could be included in the data pool, while only 2 studies compared Karydakakis and Limberg flap techniques. Therefore, the authors concluded that more high-quality comparative studies are warranted to reach a definitive conclusion [7]. Orhalmi et al. [8] compared Limberg flap and Karydakakis flap in their study in 2014 and found similarly good results with both techniques. Guner et al. [9] in their study comparing Bascom and Limberg flap techniques, reported on the specific advantages of each approach. Ozdemir et al. [10] used off-midline closure using the whole natal cleft excision technique in 234 patients in 2014 with successful results. Although off-midline surgery is recommended as the standard treatment for PS in the meta-analysis by McCallum et al. [2], it should also be pointed out that no adequate prospective, randomized studies have been performed that directly compared different off-midline approaches and that such studies are warranted. Thus, our study involved the comparison of two off-midline techniques, i.e., Limberg flap technique and Mutaf triangular closure technique.

In Mutaf triangular closure method, unequal z-plasty allows extra tissue relaxation and the donor area may be closed with primary closure. In the study where Mutaf describes his technique, a good vascularization was reported in the flap tissue in 5 patients with large myelomeningocele defects [3]. On the other hand, Limberg flap technique was reported to provide adequate closure for small or medium-sized myelomeningocele defects, while it was shown to fail in providing adequate tension-free closure in larger defects [11]. Also, in a study by Mutaf involving PS patients, a first flap for the closure of the defect area and a second flap covering the donor area, together with an unequal z-plasty, allowed better tissue relaxation and was able to provide tension-free closure even in large defects [3].

PS occurs more commonly in the second or third decades of life with a male to female ratio of 2.2–4 to 1 (males prevalent is 2.2–4 times more than females) [1]. More frequent occurrence of this condition in the young and working population places more significance on PS due to its influence on professional and social life. In our study, the male to female ratio was 70:11 (i.e., 6.36), once more confirming a higher frequency among male subjects. Similar to previous reports, patients between 18 and 29 years of age comprised the majority of our study participants

[1].

Ideal PS surgery should be associated with low risk of surgical-site complications. In a study by Petersen et al., [12] the incidence of wound site infections was 12% with the Karydakakis flap technique. In two different studies, the reported rates of infection for Limberg flap varied between 0.8% and 3% [11,13]. Guner et al. [9] performed a Limberg flap in 61 patients and found an overall infection rate of 9.7% including both superficial and deep infections. In our study, infection occurred in 7.3% of patients in Limberg flap group and in 20% of patients in Mutaf technique group, with no significant differences between the 2 groups ( $P = 0.096$ ).

The higher rate of infection despite low occurrence of seroma formation was explained on the basis of inadequate personal hygiene and use of surgical drains in two different studies [14,15]. In the present study, the time to drain removal was 4.07 and 9.42 days in groups 1 and 2, respectively, with a significant difference in this regard ( $P < 0.001$ ). Also, seroma formation was not observed in any patients in group 1 vs. in 12% of patients in group 2, again with a significant difference ( $P = 0.026$ ). Due to the use of two different flaps in Mutaf technique, more frequent formation of seromas and more prolonged need for surgical drains were not considered unexpected. Similarly, higher rate of infections in patients treated with Mutaf technique was probably associated with these two factors, i.e., seromas and prolonged time to drain removal. Of the 8 patients with infections in Mutaf technique group, only 1 had deep surgical site infection, while 7 were found to have superficial skin infections.

In a study examining wound dehiscence, classical Limberg flaps were associated with higher rates of wound dehiscence as compared to a modified Limberg flap technique (23%, 3%,  $P = 0.03$ ) [2]. In the present study, the dehiscence rates were 0% and 2.5% in groups 1 and 2, respectively ( $P > 0.05$ ). A previous study reported no patients developing hematoma after PS surgery with Limberg flap or Bascom techniques [9]. In our study, 0% and 2.5% of patients in groups 1 and 2 had hematoma formation, respectively ( $P > 0.05$ ).

A determinant of postoperative success in patients undergoing PS surgery is local sensory loss at the site of surgery, which occurred in 48.8% and 65% of our patients in groups 1 and 2, respectively ( $P = 0.141$ ). Preparation of 2 flaps with the Mutaf technique was associated with increased rates of local sensory loss, although this was not considered a disadvantage as reflected by the absence of significant differences between the 2 groups.

Earlier completion of postoperative wound healing allows earlier return to normal daily activities. In a study examining the healing time in Limberg flap and Bascom techniques, the respective healing times of 11.55 and 11.50 days were reported [9]. In another study, the wound healing time reported for a

modified Limberg technique was 14 days [16,17]. In our study, the corresponding values in groups 1 and 2 were 11.56 and 15.4 days, respectively ( $P < 0.001$ ). The more prolonged healing process in the group treated with Mutaf technique was thought to be associated with the longer time to removal of the drain, which probably caused a relative increase in the time to healing and a statistically significant difference.

Postoperative pain is an important factor for patients' comfort and an ideal surgical technique should be associated with minimum pain. In three different studies, Limberg flap technique was compared with primary closure and secondary healing, and was found to cause less pain than other groups [18-20]. In a prospective study with 122 patients, Limberg flap was compared with Bascom technique, with no significant differences in VAS scores between the two groups [9]. In our study, VAS scores at 1, 10 and 30 days after surgery, the mean scores on day 1 in groups 1 and 2 were 1.68 and 1.05, respectively, with lesser intensity of pain in patients in Mutaf technique group ( $P = 0.048$ ); VAS scores at postoperative day 10 and 30 were not significantly different ( $P > 0.05$ ). This difference on day 1 was probably due to the presence of a tension-free flap, which was prepared using 2 separate flaps.

Duration of hospital stay after surgery is linked with cost-effectiveness and patient satisfaction of a specific surgical technique. In three different studies, the length of hospital stay in patients undergoing PS surgery with Limberg technique were 2, 4, and 6 days respectively [16,21,22]. In our study, the length of hospital stay in groups 1 and 2 were 2.49 and 3.38 days, respectively, with no significant difference in this regard ( $P = 0.06$ ). Thus, neither technique was associated with significantly prolonged hospital stay.

In the study by Guner et al., [9] the duration of surgery was 36 minutes (range, 22–50 minutes) and 29 minutes (range, 20–42 minutes) for Limberg and Bascom techniques, respectively ( $P < 0.0001$ ). In our study, this value in groups 1 and 2 were  $34.27 \pm 8$  and  $31.60 \pm 9.2$  minutes. The surgery time observed in our patient groups is consistent with previous reports and no significant differences were detected between the 2 groups.

Previously, BMI has been found to bear clinical significance in terms of the risk of surgical-site related complications and recurrence. For instance, a direct link between BMI and wound infection, wound dehiscence, and recurrence rate was found in two previous studies [23,24]. In a study by Sievert et al. [25]

examining the effect of lifestyle on long-term recurrence risk in a total of 534 patients and in another study by Poorghasem and Mahoori [26] again looking at the effect of BMI on recurrence rates, recurrent PS was found to occur primarily in those with a BMI of greater than  $30 \text{ kg/m}^2$  (obese) or in those with a BMI between  $25\text{--}30 \text{ kg/m}^2$  (overweight), with reduced recurrence in those having a BMI below  $25 \text{ kg/m}^2$  [26]. In another study Alptekin et al. [27] found higher recurrence rates in patients with a high volume of specimen regardless of the operation method. In our study, a patient who had wound dehiscence and recurrence had a BMI between 25 and  $29.9 \text{ kg/m}^2$  (i.e., overweight). Another patient with recurrence had a BMI  $> 30 \text{ kg/m}^2$ , again consistent with previous reports. All 5 patients (45%) with wound site infection had a BMI greater than 30 (i.e., obese).

The primary priority in PS surgery is to prevent recurrences. In a 7,471 patient series reported by Karydakos [28], the reported rate of recurrence was 1%. In a study by Tezel et al. [29], the reported recurrence rate with Bascom cleft lift technique was 1.3%. In a review by Petersen et al. [16] involving 16 studies of Limberg flap technique, a recurrence rate of 1.5% (range, 0.8%–2.7%) was found. In our study the recurrence rates in groups 1 and 2 were 2.4% and 5%, respectively, with no significant differences ( $P > 0.616$ ). Therefore, Limberg flap and Mutaf techniques had a comparable early recurrence rate. Although Mutaf technique was associated with more frequent seroma formation, prolonged time to drain removal, and prolonged healing time, the 2 groups were similar in terms of early recurrence rate, wound site induration, wound dehiscence, hematoma formation, local sensory loss, and infection rate. Also, a lower VAS score at day 1 in Mutaf technique group was considered as an advantage. Therefore, we believe that Mutaf triangular closure technique may represent a viable surgical therapeutic alternative among off-midline approaches. This view should be supported with larger clinical samples involving the use of this technique in larger defects and involving longer-term follow-up.

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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