

# Association of Autologous Costal Cartilage Harvesting Technique With Donor-Site Pain in Patients Undergoing Rhinoplasty

Berke Özücer, MD; Mehmet Emre Dinç, MD; Ceki Paltura, MD; İlker Koçak, MD; Denizhan Dizdar, MD; Oğuz Çörtük, MD; Ömer Uysal, MD

 Supplemental content

**IMPORTANCE** Postoperative pain at the donor site is a common morbidity following autologous costal cartilage grafting.

**OBJECTIVE** To evaluate postoperative pain at the donor site after the use of a muscle-sparing costal cartilage harvesting technique compared with a muscle-cutting technique using electrocautery.

**DESIGN, SETTING, AND PARTICIPANTS** Designed as a controlled trial without randomization, this prospective, comparative cohort study was conducted between January 1, 2016, and March 31, 2017. Participants included 20 patients who underwent rhinoplasty for various cosmetic and functional complaints from January 1, 2016, to February 28, 2017. Of the 20 patients, 1 was excluded owing to an infection that developed on postoperative day (POD) 7. Patients were grouped by the rib harvesting technique used that was either a muscle-sparing technique ( $n = 11$ ) or a muscle-cutting technique ( $n = 8$ ). Skin incisions for both groups were carried out with a blade. Transection of muscle fascia and muscle fibers was performed with monopolar electrocautery in the muscle-cutting technique group. Blunt dissection with a hemostat was performed in the muscle-sparing technique group. All other surgical techniques were identical.

**MAIN OUTCOMES AND MEASURES** Postoperative pain was assessed with visual analog scale scores for resting pain and movement pain. Eight pain measurements were noted at the sixth postoperative hour and on PODs 1, 2, 3, 7, 15, 30, and 45. During the hospital stay, the postoperative need for analgesics was recorded daily as the number of analgesic infusion vials used.

**RESULTS** The 19 patients in the study included 11 women and 8 men whose mean age (SD) was 33.2 (10.3) years. The mean (SD) visual pain analog scale scores for resting pain and movement pain were consistently higher in the muscle-cutting technique group than in the muscle-sparing technique group. This difference was statistically significant on PODs 2, 3, and 15 for resting pain and on PODs 2, 3, 7, 15, 30, and 45 for movement pain. The mean postoperative need for analgesic infusion vials during hospital stay was higher in the muscle-cutting technique group, and the difference was statistically significant on POD 2 (1.9 [0.6] vials vs 1.0 [0.9] vials;  $P = .02$ ).

**CONCLUSIONS AND RELEVANCE** Both resting and movement pain at the donor site was significantly reduced in the muscle-sparing technique group during the postoperative period, findings that align with anecdotal reports in the literature. Routine use of the muscle-sparing technique in autologous costal cartilage harvesting is recommended to reduce postoperative pain.

**LEVEL OF EVIDENCE** 2.

**Author Affiliations:** Department of Otorhinolaryngology, Gaziosmanpasa Taksim Research and Education Hospital, Istanbul, Turkey (Özücer, Dinç, Paltura); Department of Otolaryngology, Koc University Hospital, Istanbul, Turkey (Koçak); Medical Faculty, Department of Otorhinolaryngology, Istanbul Kemerburgaz University, Istanbul, Turkey (Dizdar); Department of Plastic and Reconstructive Surgery, Gaziosmanpasa Taksim Research and Education Hospital, Istanbul, Turkey (Çörtük); Department of Biostatistics, Bezmialem Vakif University, Istanbul, Turkey (Uysal).

**Corresponding Author:** Berke Özücer, MD, Department of Otorhinolaryngology, Gaziosmanpasa Taksim Research and Education Hospital, Istanbul, Turkey (berkeozucer@gmail.com).

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Satisfactory long-term results in primary and revision rhinoplasty depend on adequate reconstruction of the nasal osseocartilaginous framework. Autologous costal cartilage grafting (ACCG), with its abundance and support, is considered the workhorse graft of revision rhinoplasty. Numerous complications are associated with the use of ACCG in rhinoplasty, and these complications are grouped as either donor-site or recipient-site morbidities.<sup>1,2</sup>

Postoperative pain—both resting and movement pain—at the donor site is very common following the harvesting of rib cartilage. Many approaches are described in the literature to reduce postoperative pain at the donor site.<sup>3-5</sup> Anecdotal reports from influential investigators suggest that a muscle-sparing technique during ACCG may reduce postoperative pain and the need for postoperative analgesics<sup>6,7</sup>; however, the impact associated with this muscle-sparing technique has not been investigated in an evidence-based medicine perspective.

The aim of this study, which was designed as a prospective comparative controlled cohort trial without randomization, was to compare the postoperative resting and movement pain at the donor site and the need for analgesics associated with the muscle-sparing and the muscle-cutting costal cartilage harvesting techniques.

## Methods

This study was conducted between January 1, 2016, and March 31, 2017. Undergoing rhinoplasty and having an indication for full-thickness ACCG were the main inclusion criteria for this study. Having partial-thickness ACCG, history of fibromyalgia, no consent, and postoperative seroma or infection at the donor site were among the exclusion criteria. The primary outcome was the pain visual pain analog scale (VAS)<sup>5</sup> score, and the secondary outcome was the postoperative need for analgesics; these outcomes were evaluated by one of us (M.E.D.), who was blinded to the interventions. The local ethics committee of Gaziosmanpasa Taksim Research and Education Hospital, Istanbul, Turkey, approved the study, and all patients provided written informed consent.

### Surgical Technique

All patients (n = 19), who had rhinoplasty for various cosmetic and functional complaints, underwent the operation under general anesthesia. All autologous costal cartilages were harvested by one of us (B.O.) at the Department of Otorhinolaryngology, Gaziosmanpasa Taksim Research and Education Hospital. Local infiltration was carried out 15 minutes before surgical preparation. The sixth rib cartilage of the right side was preferred.

### Muscle-Cutting Technique Group

Skin incision for the muscle-cutting technique group (n = 8) was made with a No. 15 blade. All layers, including the subcutaneous fat, muscle fascia, and muscles covering the cartilage, were transected with a monopolar electrocautery device (Force 2 Electrosurgical Generator; Valley Laboratory) set at 25 W and adjusted to “blend 1.”

## Key Points

**Question** Does a muscle-sparing rib harvesting technique reduce postoperative donor-site pain compared with a muscle-cutting technique?

**Findings** In this cohort study of 19 patients, postoperative resting and movement pain scores were consistently lower in the muscle-sparing group, with significant differences between groups on several postoperative days. The postoperative need for analgesics was also reduced compared with the need in the muscle-cutting group, with a significant difference between groups on postoperative day 2.

**Meaning** Because the results of this study agree with anecdotal reports from influential authors, routine use of a muscle-sparing technique for rib harvesting for reducing postoperative pain at the donor site is suggested.

### Muscle-Sparing Technique Group

The muscle-sparing technique group (n = 11) also received the skin incision with a No. 15 blade. Subcutaneous layers were dissected bluntly with a hemostat. Deep muscular fascia was divided in the direction of the underlying muscle fibers with a blunt hemostat. The muscle itself was not cut with an electrocautery device; instead, it was divided bluntly by spreading in the direction of the muscle fibers with a hemostat, and dissection was concluded with freer elevators.

After harvesting, the donor sites of all patients in both groups were abundantly irrigated with saline, and bleeding control was carried out with bipolar electrocautery. All patients' surgical wound site in both groups was filled with saline, and positive thoracic pressure was used. Absence of air bubbles was used to discard pleural injury. Next, a minivac drain was inserted and a layer-by-layer closure was ensured with absorbable polyglactin 910 suture (Vicryl 4-0; Ethicon US LLC). Postoperative suggestions, orders, and medications were identical for both groups. Patients were informed that they had access to ad libitum analgesics and were administered only as needed at 10 mg/mL from 100-mL paracetamol infusion vials. All patients were discharged from the hospital in the morning of the third postoperative day, following the removal of the drain.

### Assessment of Outcomes

Postoperative pain was evaluated with the VAS score as previously described in the literature.<sup>3,5,8-10</sup> Patients were questioned about their donor-site pain and asked to rate their pain on the scale of 0 (no pain) to 10 (maximum pain). Resting pain and movement pain (ie, during active torso rotation) VAS scores were recorded separately. This evaluation was carried out during the sixth postoperative hour on the day of operation (postoperative day [POD] 0); PODs 1, 2, and 3; the first postoperative week (POD 7); and PODs 15, 30, and 45). Postoperative need for analgesics (10 mg/mL, 100-mL paracetamol infusion vials) was noted as the number of infusion vials used for 3 days spent in the hospital.

### Statistical Analysis

All statistical analyses were carried out by one of us, a biostatistician (O.U.), using SPSS software, version 20.0 (IBM). All values were calculated and stated in descriptive statistics as mean

(SD) unless otherwise indicated. The Mann-Whitney test was used for comparison of means for intergroup analysis. The significance of intragroup repeated measures was analyzed with the nonparametric Friedman test. A 2-sided  $P < .05$  was considered statistically significant.

## Results

A total of 20 patients underwent an operation between January 1, 2016, and February 28, 2017. Of these 20 patients, only 1 (5%) was excluded from the study for an infection that developed on POD 7 (eTable in the Supplement). No other intraoperative or postoperative complication was seen. The 19 patients in the study included 11 women and 8 men, whose mean age (SD) was 33.2 (10.3) years (Table 1 provides more demographic data). Eight of 19 patients (42%) were secondary revision cases, 3 of 19 patients (16%) were tertiary revision cases, 3 of 19 patients (16%) were operated for correction of a saddle nose deformity, 3 of 19 patients (16%) had primary rhino-

plasty and septoplasty operation, 1 of 19 patients (5%) had a bilateral cleft lip procedure, 1 of 19 patients (5%) was a severe trauma primary case (eTable in the Supplement).

The mean (SD) postoperative VAS scores were consistently higher in the muscle-cutting technique group compared with the muscle-sparing technique group (which are detailed in Table 2 and Table 3 as well as Figure 1). Intragroup repeated measures in both groups were significant at  $P < .001$  for resting and movement pain (Table 2). The postoperative need for analgesic infusion vials during the hospital stay was higher in the muscle-cutting technique group than the muscle-sparing technique group, and this difference was statistically significant on POD 2 (mean [SD] number, 1.9 [0.6] vs 1.0 [0.9] vials;  $P = .02$ ; Figure 2).

## Discussion

The major donor-site morbidities associated with rib harvesting are pneumothorax, infection, seroma, scarring, and post-

Table 1. Patient Demographic Data and Results Summary

Characteristic	MS Technique Group (n = 11)	MC Technique Group (n = 8)	P Value	z Score
Sex, No. (%)				
Female	7 (64)	4 (50)		
Male	4 (36)	4 (50)		
Age, mean (SD), y	34.8 (11.5)	31.0 (8.5)	.59	-0.54
Analgesic need, mean (SD), No. of vials <sup>a</sup>				
POD 0 <sup>b</sup>	1.4 (0.7)	1.9 (0.6)	.07	-1.79
POD 1	1.9 (0.5)	2.0 (0.5)	.71	-0.37
POD 2	1.0 (0.9)	1.9 (0.6)	.02	-2.27

Abbreviations: MC, muscle-cutting; MS, muscle-sparing; POD, postoperative day.

<sup>a</sup> Analgesic need is the number of 100-mL paracetamol infusion vials used during the first 3 days of the hospital stay.

<sup>b</sup> POD 0 represents the day of operation.

Table 2. Postoperative VAS Scores for Resting and Movement Pain<sup>a</sup>

Postoperative Day by Type of Pain	VAS Score by Technique for Autologous Costal Cartilage Harvesting, Mean (SD)		P Value	z Score
	MS Technique Group (n = 11)	MC Technique Group (n = 8)		
Resting pain				
0 <sup>b</sup>	2.1 (2.1)	3.0 (1.3)	.445	-0.76
1	2.1 (2.0)	4.1 (1.2)	.03	-2.15
2	1.0 (1.2)	3.9 (2.1)	.007	-2.70
3	0.6 (0.8)	2.9 (1.6)	.004	-2.90
7	0.6 (0.8)	1.5 (1.2)	.06	-1.85
15	0.2 (0.4)	0.9 (0.6)	.01	-2.47
30	0.0 (0.0)	0.3 (0.5)	.08	-1.71
45	0.0 (0.0)	0.0 (0.0)	>.99	0.00
Movement pain				
0 <sup>b</sup>	5.0 (2.1)	5.6 (1.4)	.61	-0.51
1	5.1 (2.1)	6.4 (1.2)	.20	-1.27
2	2.5 (1.5)	6.4 (1.7)	.001	-3.30
3	1.9 (1.3)	5.1 (1.6)	.002	-3.17
7	1.6 (1.2)	3.1 (1.1)	.01	-2.49
15	0.7 (0.6)	1.8 (0.7)	.006	-2.78
30	0.3 (0.5)	1.3 (0.7)	.005	-2.79
45	0.0 (0.0)	0.8 (0.9)	.01	-2.55

Abbreviations: MC, muscle-cutting; MS, muscle-sparing; VAS, visual pain analog scale.

<sup>a</sup> The VAS ranged from 0 (no pain) to 10 (maximum pain or worst pain imaginable). Analysis of intragroup repeated measures in both groups was significant for resting and movement pain separately ( $P < .001$ ).

<sup>b</sup> Postoperative day 0 represents the day of operation.

operative pain. The latest research on this issue reported scarring as the most frequent donor-site complication, and temporary pain at the donor site is not regarded as a complication.<sup>11</sup> Postoperative pain at the donor site is frequent in our practice,<sup>1,2</sup> with pain in the chest wall being common. Resting pain is alleviated after the first week, but movement pain persists and patients experience significant discomfort several weeks after an operation (Table 2). During the postoperative period, most patients abstain from activity and behave as if they have had a major local rib injury. Therefore, quality of life is severely reduced, especially in the early postoperative period.

Our review of the literature revealed the different autologous costal cartilage harvesting techniques used in facial plastic surgery.<sup>2,6,12-16</sup> For example, Daniel,<sup>12</sup> Marin et al,<sup>13</sup> and

Cochran<sup>14</sup> describe the muscle-cutting technique. In addition, Çakmak and Ergin<sup>15(p174)</sup> reported that “[a]lthough it was temporary, chest pain, which restricts patients’ activities in the early postoperative period, was the most significant problem in our series. We tried to minimize this pain by leaving the muscle fibers intact and the ribs continuous, but it was still the most important cause of morbidity associated with the procedure.” Toriumi and Swartout<sup>7</sup> defined a rib harvesting technique with a hemostat. Fedok<sup>6</sup> reported his experience: “In [my] patients, severe postprocedure pain has essentially been eliminated by the muscle-sparing cartilage-harvesting technique.” In our experience, the muscle-sparing method is the routinely used surgical technique.

Our results, despite the limited sample size of this study, show that the muscle-sparing technique reduces postopera-

Table 3. Changes in VAS Scores Between Measurements<sup>a</sup>

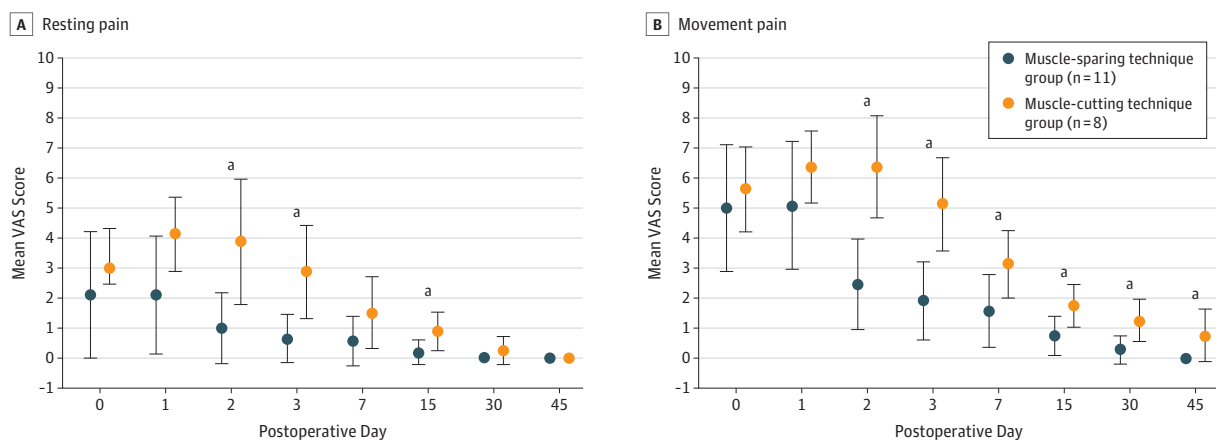
Postoperative Days by Type of Pain	Change in VAS Score, Mean (SD)		P Value	z Score
	MS Technique Group (n = 11)	MC Technique Group (n = 8)		
<b>Resting pain</b>				
0 Δ 1 <sup>b</sup>	0.0 (0.8)	-1.1 (1.6)	.14	-1.50
1 Δ 2	-1.1 (1.3)	-0.3 (1.4)	.24	-1.17
2 Δ 3	-0.4 (0.5)	-1.0 (0.9)	.07	-1.77
3 Δ 7	-0.1 (0.3)	-1.4 (1.2)	.009	-2.62
7 Δ 15	-0.4 (0.5)	-0.6 (0.7)	.45	-0.76
15 Δ 30	-0.2 (0.4)	-0.6 (0.5)	.054	-1.93
30 Δ 45	0.0 (0.0)	-0.3 (0.5)	.09	-1.71
<b>Movement pain</b>				
0 Δ 1 <sup>b</sup>	-0.1 (1.3)	-0.8 (2.1)	.37	-.89
1 Δ 2	-2.6 (1.4)	0.0 (1.1)	.001	-3.46
2 Δ 3	-0.6 (0.5)	-1.3 (0.7)	.02	-2.33
3 Δ 7	-0.4 (0.5)	-2.0 (0.8)	.001	-3.46
7 Δ 15	-0.8 (1.0)	-1.4 (0.7)	.21	-1.27
15 Δ 30	-0.5 (0.5)	-0.5 (0.5)	.85	-0.19
30 Δ 45	-0.3 (0.5)	-0.5 (0.5)	.32	-0.99

Abbreviations: Δ, change in measurement; MC, muscle-cutting; MS, muscle-sparing; VAS, visual pain analog scale.

<sup>a</sup> The VAS ranged from 0 (no pain) to 10 (maximum pain or worst pain imaginable).

<sup>b</sup> Postoperative day 0 represents the day of operation.

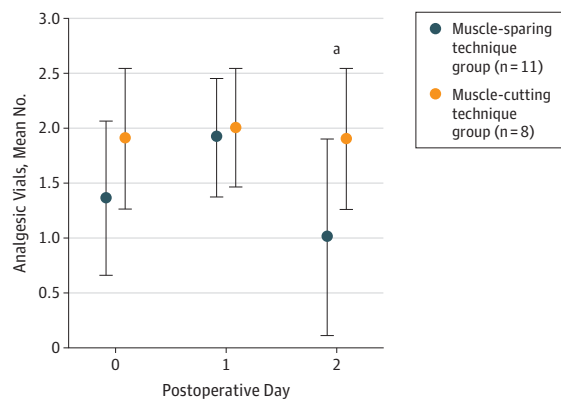
Figure 1. Visual Analog Pain Scale (VAS) Scores



The VAS score ranges from 0 (no pain) to 10 (maximum pain or worst pain imaginable). Postoperative day 0 represents the day of operation; error bars, SD.

<sup>a</sup>  $P < .05$  compared with the muscle-sparing technique group.

Figure 2. Postoperative Need for Analgesics



Postoperative day (POD) 0 represents the day of operation; error bars, SD.

<sup>a</sup>  $P = .02$  compared with the muscle-sparing technique group.

tive pain. This benefit is more pronounced in the early postoperative period and is especially dramatic for movement pain. The use of muscle-repairing sutures contributes to faster healing with less pain. In contrast, pain from the muscle-cutting

technique can be attributed to the necrosis caused by the thermal injury of the electrocautery device.

### Limitations

The sex imbalance between groups is a limitation of this study, although one study showed that, compared with men, women experience more severe pain (accompanied with higher VAS scores) and require a greater dose of analgesics in the postoperative period.<sup>17</sup> There were more women than men in the muscle-sparing technique group, but nearly all VAS scores in the group were lower than the VAS scores in the muscle-cutting technique group (Figure 2). Therefore, to our knowledge, this imbalance does not bias the conclusion of the study and lead to type I error.

### Conclusions

Use of a muscle-sparing technique in ACCG decreases both resting and movement pain at the donor site during the postoperative period. We suggest the routine use of a muscle-sparing technique to reduce postoperative morbidity.

### ARTICLE INFORMATION

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**Author Contributions:** Dr Özücer had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Study concept and design:** Özücer, Dinç, Koçak.  
**Acquisition, analysis, or interpretation of data:** All authors.

**Drafting of the manuscript:** Özücer, Dinç, Koçak, Uysal.

**Critical revision of the manuscript for important intellectual content:** Özücer, Paltura, Koçak, Dizdar, Çörtük.

**Statistical analysis:** Özücer, Uysal.

**Obtained funding:** Paltura.

**Administrative, technical, or material support:** Dinç, Paltura, Dizdar, Çörtük.

**Study supervision:** Uysal.

**Conflict of Interest Disclosures:** None reported.

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