Original Article

Investigating the Effect of Bilateral Facial Repositioning Using a Mattress Suture to Correct a Very Wide Alar Base in Rhinoplasty

Melika Hajirahimi[1], Rohollah Abbasi[1*], Javaneh Jahanshahi[1], Amin Doosti-Irani[2]

1. Department of Otolaryngology, School of Medicine, Hamadan University of Medical Sciences, Hamadan, Iran
2 Department of Epidemiology, School of Medicine, Hamadan University of Medical Sciences, Hamadan, Iran

***Corresponding Author:**

Rohollah Abbasi,

Department of Otolaryngology, School of Medicine, Hamadan University of Medical Sciences, Hamadan, Iran

Tel.: +989177089117
Email: hamru58@hotmail.com

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ABSTRACT

Background: In recent years, the prevalence of various rhinoplasty procedures has increased. Alar base reduction (ABR) techniques are utilized in approximately 15–20% of these patients. Major studies indicate that under correction of alar base is a primary cause of patient dissatisfaction and suboptimal outcomes. We aimed to compare conventional bilateral ABR with a modified technique involving bilateral facial repositioning (bilateral facial medial advancement) using a mattress suture (BFR-mattress).

Methods: Forty-two septorhinoplasty candidates requiring ABR were enrolled into two groups: a control group (conventional bilateral ABR) and an intervention group (ABR with BFR-mattress). Standardized photographic documentation was obtained preoperatively and at the 6-month follow-up. Outcomes were assessed based on patient-reported satisfaction and evaluations by blinded independent surgeon.

Results: No significant differences were found between the groups in demographic parameters (age, sex distribution; $P > 0.05$). Preoperative interalar-to-intercanthal ratios were comparable between the groups (Control: 1.21 ± 0.12, Intervention: 1.20 ± 0.06; $P = 0.885$). At 6 months, the intervention group exhibited significantly lower ratios (1.13 ± 0.09 [in control group] vs. 1.04 ± 0.07 [in intervention group]; $P = 0.003$), indicating more narrowing of the alar base. Notably, despite achieving greater alar base reduction, the BFR-mattress technique resulted in comparable outcomes in nasal obstruction, symmetry and scar appearance.

Conclusion: The BFR-mattress suture technique provides significantly greater alar base width reduction compared to conventional ABR, without increasing complication rates.

KEYWORDS
Alar base reduction; Facial medial advancement; Facial repositioning; Rhinoplasty

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INTRODUCTION

Rhinoplasty has witnessed a substantial increase in procedural volume in recent years, characterized by intricate technical nuances and diverse aesthetic objectives. Achieving nasal harmony with adjacent facial structures remains paramount for optimal outcomes. The alar base and

its width are critical determinants of nasal aesthetics, with alar base reduction (ABR) representing a pivotal component of contemporary rhinoplasty procedures [1,2].
Anatomically, the bilateral alae should be symmetrically positioned between the medial canthi, with an ideal alar width approximating the intercanthal distance[3]. Variations in alar flare and nostril dimensions are influenced by multiple factors, including ethnicity, sex, age, history of trauma, and cocaine use[3,4]. Patients with an interalar-to-intercanthal ratio greater than one are typically considered to have a wide alar base and are candidates for ABR.
Surgically, tissue excision from the alar lobule reduces alar flare, while resection of the nasal sill decreases nostril width[5]. Despite its clinical utility, ABR remains underutilized by some surgeons due to concerns regarding visible scarring, iatrogenic nasal distortion, and unnatural postoperative appearance[3,6]. Although ABR is typically performed during the final stages of rhinoplasty, it may also be indicated as a standalone procedure when alar flare is the primary deformity.
Critically, major studies have identified under correction as the leading cause of patient dissatisfaction and suboptimal outcomes in ABR candidates[7,8]. Therefore, developing techniques that achieve effective alar base narrowing while minimizing complications holds significant clinical importance.
It appears that performing the ABR technique using the conventional method in patients with a wide alar base may result in columellar widening due to skin tension exerted from the sides of the alar base. However, if this peripheral skin tension can be counteracted utilizing a mattress sutures (BFR-mattress), columellar widening can be prevented.
We aimed to compare conventional bilateral ABR with a modified bilateral facial repositioning (bilateral facial medial advancement) technique utilizing mattress sutures (BFR-mattress), the technical details of which fully described in the subsequent methodology section.

MATERIALS AND METHODS

This triple-blind randomized controlled trial enrolled 42 patients (aged 18–50 years) between March 2024 and March 2025 at Besat Hospital, Hamadan, Iran.
Randomization was performed using a computer-generated random sequence in a 1:1 allocation ratio. The randomization sequence was generated by an independent statistician not involved in patient recruitment, treatment allocation, or outcome assessment. Participant enrollment was performed by the surgical team after confirming eligibility criteria.
Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes (SNOSE). The envelopes were prepared by a researcher not involved in the clinical procedures. Each envelope was opened sequentially at the time of surgery to assign participants to either the control (conventional bilateral ABR) or intervention group (ABR with bilateral BFR-mattress technique).
Blinding of the study was maintained at three levels:

1. Patients were blinded to group allocation and were not informed whether they received the standard ABR technique or the modified BFR-mattress technique.
2. The surgeon responsible for postoperative outcome assessment was blinded to the surgical technique used, as evaluations were performed based on standardized coded photographs at follow-up visits.
3. The statistician performing data analysis was blinded to group allocation, with groups labeled as A and B until completion of the statistical analysis.

Due to the nature of the surgical intervention, the operating surgeon could not be blinded; however, all intraoperative documentation was excluded from outcome assessment to minimize bias.

Inclusion Criteria

Candidates for septorhinoplasty with objectively widened alar base, defined as an interalar-to-intercanthal ratio greater than 1, commonly used in facial anthropometric assessments to indicate alar flaring beyond proportional midfacial width.

Exclusion Criteria

Pre-existing non-iatrogenic scarring in the alar-facial region, Revision rhinoplasty candidates, Patients with unrealistic aesthetic expectations or lack of acceptance of potential alar base modification, as determined during standardized preoperative counseling and documented informed consent discussion, Unilateral alar widening, Active rheumatologic disorders, Postoperative trauma, or infection.

Standardized frontal and basal view photographs were obtained preoperatively and at 6-month follow-up.

A 6-month follow-up period was selected as it represents a clinically appropriate time point for the assessment of long-term aesthetic outcomes following rhinoplasty and alar base modification. By 6 months postoperatively, the majority of postoperative edema has resolved, and soft tissue stabilization and scar maturation are largely achieved, allowing reliable evaluation of nasal contour and alar base position and represents a stable phase of wound healing after completion of primary scar remodeling. This time point is widely used in aesthetic facial surgery studies as a balance between adequate scar remodeling and practical patient follow-up compliance.

Sample size calculation was performed based on data from a study by Ritto et al (16). Comparing two different alar base sutures. Assuming a two-sided significance level ($\alpha = 0.05$) and a power of 80% ($1-\beta = 0.80$), the sample size was calculated using the following formula for comparison of two independent means:

$$n = [(Z_{1-}\alpha/2 + Z_{1-}\beta)^2 \times (\sigma_1^2 + \sigma_2^2)] / (\mu_1 - \mu_2)^2$$

Based on reported values ($\mu_1 = 2.31 \pm 0.89$ and $\mu_2 = 1.40 \pm 1.12$), the required sample size was 21 participants per group. Considering potential dropouts, a total of 42 patients (21 per group) were enrolled.

Primary Endpoints: Reduction in interalar distance (mm) and Interalar-to-intercanthal ratio.

Secondary Endpoints: Nasal symmetry (evaluated by a blinded surgeon), Patient satisfaction (Quantitative: Visual Analog Scale (VAS)), Complication rates (hematoma, hemorrhage, skin depression, scar hypertrophy, nasal obstruction). Qualitative evaluation of alar correction according to independent surgeon evaluation: Complete / Partial / No improvement / Worsening and.

Nasal symmetry based on midline alignment of nasal tip, alar base symmetry, and nostril shape comparison was evaluated at the 6-month follow-up by a blinded surgeon using standardized frontal and basal view photographs. All evaluations were performed independently on anonymized, coded images to minimize observer bias.

Patient satisfaction regarding aesthetic outcome was assessed using a VAS ranging from 0 to 10, where 0 indicated complete dissatisfaction and 10 indicated maximum satisfaction with nasal appearance. Patients were asked to mark their perceived level of satisfaction at the 6-month follow-up visit. VAS was chosen due to its simplicity, ease of understanding, and widespread use in aesthetic and surgical outcome research, allowing reliable quantification of subjective patient-reported outcomes.

Qualitative assessment of alar base correction was performed by an independent blinded surgeon using standardized pre- and postoperative photographs at 6-month follow-up. Outcomes were classified using predefined criteria based on changes in interalar distance and visual symmetry:

- **Complete improvement:** ≥75% reduction in interalar widening with restoration of balanced alar–facial proportions and no visible asymmetry.
- **Partial improvement:** 25–74% reduction in interalar distance with noticeable but incomplete correction of alar flaring.
- **No improvement:** <25% change in interalar distance with persistent preoperative appearance.
- **Worsening:** Any increase in interalar distance or deterioration in alar symmetry compared with baseline.

All classifications were performed independently on coded images to minimize bias.

All anthropometric measurements were performed using standardized digital photographic analysis. Standardized frontal and basal view photographs were obtained at baseline and at 6-month follow-up using a fixed camera setup with a constant distance of 1.5 meters, identical lighting conditions, and a neutral head position (Frankfort horizontal plane parallel to the floor). Patients were instructed to maintain a relaxed facial expression without smiling or muscular contraction.

Interalar and intercanthal distances were measured on calibrated digital images using ImageJ software (National Institutes of Health, Bethesda, MD, USA). A fixed intercanthal distance was used as an internal calibration reference to correct for magnification bias across images.

Each measurement was performed independently by two blinded evaluators, and the mean value was

used for statistical analysis. To assess measurement reliability, intra-class correlation coefficient (ICC) was calculated on a randomly selected subset of images, demonstrating high interobserver agreement.
Since the educational levels of the patients varied, the Visual Analogue Scale (VAS) was selected as the criterion for assessing the patients' perceived appearance changes, enabling patients to easily express their level of satisfaction with the changes.
All randomized participants were included in the final analysis according to the intention-to-treat (ITT) principle. During the follow-up period, loss to follow-up was minimal and occurred equally between groups. Missing outcome data were handled using complete-case analysis, as the proportion of missing data was negligible and did not exceed the threshold requiring imputation methods.
Data analysis was performed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages.
For normally distributed variables, independent samples t-test was used for between-group comparisons, while the paired t-test was applied for within-group comparisons. For non-normally distributed data, the Mann–Whitney U test and Wilcoxon signed-rank test were used, respectively. Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate.
All statistical tests were two-sided, and a *P*-value < 0.05 was considered statistically significant.

Surgical Technique

All procedures were performed under general anesthesia.
In the control group, patients underwent standard wedge resection ABR, which included preoperative marking of the planned alar wedge and completion of the alar base wedge excision followed by standard layered closure without any additional suturing techniques for alar cinching.
In the intervention group, the same standard wedge resection ABR technique was performed, followed by placement of the BFR-mattress suture at the alar-facial junction, as described below.
Figure 1 illustrates the step-by-step BFR-mattress suture protocol: (A) Preoperative wide alar base. (B) Marking of planned wedge resection margins. (C) Completion of alar base wedge excision. (D) Passage of a 4-0 nylon suture through the right alar base soft tissue above the alar-facial groove. (E) Introduction of a gray angiocatheter from left to right across the operative field. (F) Advancement of the suture needle through the angiocatheter lumen followed by withdrawal of the catheter. (G) Passage of the suture through the left alar base soft tissue above the groove. (H) Re-insertion of the angiocatheter from right to left along the alar-facial axis. (I) Advancement of the needle through the catheter lumen and removal

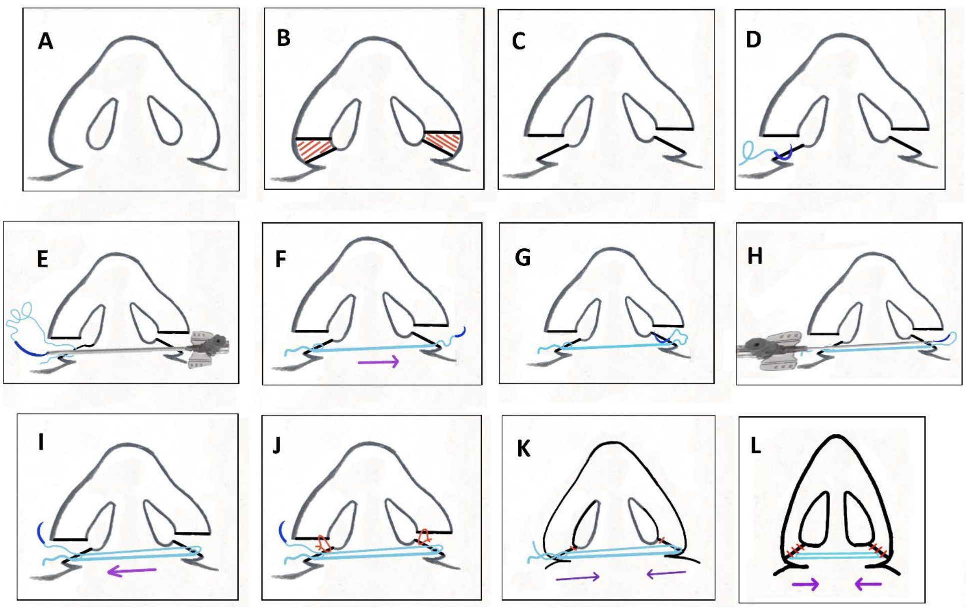

Fig. 1. BFR-Mattress Suture Protocol

of the catheter. (J) Placement of a temporary 6-0 nylon suture at the caudal incision margin. (K) Final tying of the 4-0 nylon mattress suture under direct visualization to achieve controlled narrowing of the alar base. (L) Completion of layered skin closure.

RESULTS

All 42 patients (mean age: 34.16 ± 9.08 years; 31 females [73.8%], 11 males [26.2%]) completed the 6-month follow-up with standardized photographic documentation. No significant intergroup differences were found in age or sex distribution (Table 1).

Analysis of patient-reported outcomes showed no statistically significant differences between the groups in satisfaction scores (VAS: 0–10), revision surgery request rates, complication incidence (hematoma, hemorrhage, scar hypertrophy), or severity of postoperative nasal obstruction (scored 0–10) (Table 2).

Blinded evaluation by an independent surgeon confirmed preoperative equivalence between groups in terms of baseline interalar distance, interalar-to-intercanthal ratio (Control: 1.21 ± 0.12; Intervention: 1.20 ± 0.06; *P* = 0.885), and alar symmetry (Table 3).

Postoperative analysis revealed that the mean interalar distance decreased from 3.62 ± 0.24 cm to 3.38 ± 0.22 cm in the control group, and from 3.70 ± 0.15 cm to 3.20 ±0.25 cm in the intervention group. The difference between groups was statistically significant (*P* = 0.018). Similarly, interalar-to-intercanthal ratios decreased to 1.13 ± 0.09 in the control group and 1.04 ± 0.07 in the intervention group (*P* = 0.003) (Table 3).

Qualitative assessments further confirmed higher rates of complete correction in the intervention group, while nasal symmetry outcomes remained comparable between the groups (Table 3).

Postoperative complications, including hematoma,

Table 1. Baseline Demographic Characteristics of the Study Participants

Characteristic		BFR-Mattress	ABR alone	*P*-value
Age(yr)	Mean ±Std	35.23 ±10.47	33.09 ±7.55	0.452
Gender	Female	16 (76.2%)	15 (71.4%)	0.726
	Male	5 (23.8%)	6 (28.6%)	

Table 2. Surgical outcomes according to the patient's perspective

Variable	BFR-Mattress	ABR alone	*P*-value
Satisfaction (VAS 0-10): Mean ±Std	7.80 ±2.33	7.66 ±2.35	0.844
Nasal obstruction: Mean ±Std	3.33 ±3.18	4.14 ±3.51	0.438

Fig. 2. Preoperative and postoperative basal view of patient undergoing surgery using the BFR-mattress suture technique

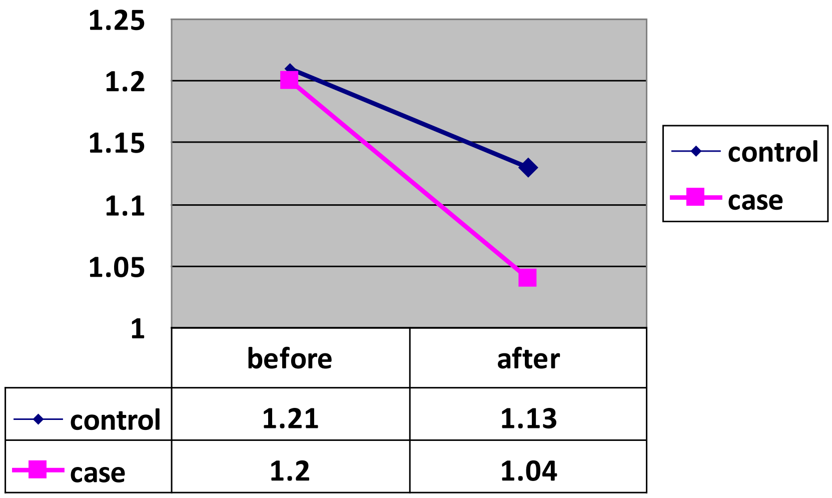

Fig. 3. Changes in the interalar-to-intercanthal ratio in both patient groups before and after surgery

Table 3. Surgical outcomes according to independent surgeon evaluation

Variable		BFR-Mattress	ABR alone	*P*-value
Symmetric		17 (81%)	14 (66.7%)	0.292
Scar		1 (4.8%)	2 (9.5%)	0.549
Interalar distance before surgery (cm): Mean ±Std		3.70 ±0.15	3.62 ±0.24	0.232
Interalar distance after surgery (cm): Mean ±Std		3.20 ±0.25	3.38 ±0.22	0.018*
Interalar to intercanthal ration before surgery: Mean ±Std		1.20 ±0.06	1.21 ±0.12	0.885
Interalar to intercanthal ration after surgery: Mean ±Std		1.04 ±0.07	1.13 ±0.09	0.003*
Qualitative evaluation of alar correction	Worsened	0 (0%)	0 (0%)	0.014*
	No change	0 (0%)	2 (9.5%)	
	Partially improved	4 (19%)	11 (52.4%)	
	Markedly improved	17 (81%)	8 (38.1%)	

Table 4. Postoperative Complications and Reoperation Rates in the BFR-Mattress and Conventional ABR Groups

Variable	BFR-Mattress	ABR alone	*P*-value
Need for reoperation (according to alar widening)	5 (23.8%)	7 (33.3%)	0.495
Hematoma	1 (4.8%)	0 (0%)	0.311
Rhinorrhea	1 (4.8%)	0 (0%)	0.311
Hyposmia	1 (4.8%)	1 (4.8%)	-
Nasal obstruction: Mean ±Std	3.33 ±3.18	4.14 ±3.51	0.438

rhinorrhea, hyposmia, nasal obstruction, and the need for reoperation, were compared between the BFR-mattress and conventional ABR groups. There were no statistically significant differences between the two groups regarding postoperative complications or reoperation rates (Table 4).

DISCUSSION

ABR performed to address nasal base widening or excessive alar flare[7], carries inherent risks such as visible scarring and nostril asymmetry[8]. While a variety of ABR techniques have been described—

each with distinct advantages and limitations—approximately 15–20% of rhinoplasty procedures incorporate ABR[9]. Contemporary evidence suggests that under correction remains the most common cause of patient dissatisfaction (with an estimated prevalence of 5.8%), although suboptimal outcomes are frequently misattributed to scar visibility[8,10]. This highlights the need for techniques that consistently achieve adequate alar narrowing while minimizing aesthetic complications.

In this trial, all patients presented with preoperative alar widening, evidenced by elevated interalar-to-intercanthal ratios, with no significant intergroup demographic differences—a critical consideration given the influence of age and sex on scar healing. While both groups exhibited comparable baseline ratios, the BFR-mattress cohort demonstrated significantly greater reduction at six months. Importantly, this enhanced efficacy was not associated with increased complication rates or compromised symmetry—findings that carry meaningful clinical implications.

It is important to note that the patients included in our study were all of Iranian and Middle Eastern ethnicity, who are known to have thicker skin and a wider nasal base. However, the results of this study may not be generalizable to other ethnic groups with different nasal anatomies.

The mean reduction in alar width (5 mm) observed in the intervention group aligns with outcomes reported by Gruber, who achieved 6–8 mm reductions using a conceptually similar mattress suture technique[11]. The method introduced by Gruber is more invasive compared to our technique, and furthermore, carries a potential risk of future fibrosis formation. In contrast, our method, which utilizes only a single angiocatheter, is associated with a lower likelihood of complications and destruction of primary anatomical structures.

Khan's cylindrical soft-tissue excision technique demonstrated acceptable scarring in 75% of patients[12], similar to our low complication rates; however, the absence of objective reduction metrics in Khan's study limits direct efficacy comparisons. Abdelkader's sandwich technique, which incorporates trapezoidal grafting, preserved the natural alar curvature while achieving a 3 mm flare reduction[13]. Although conceptually distinct from our method, this supports the broader principle that adjunctive techniques can enhance ABR outcomes without compromising aesthetic integrity.

Kamburoğlu's zigzag incision technique similarly yielded favorable scarring and symmetry outcomes[14], However, although the Camberg method resulted in less noticeable scarring, it did not demonstrate a greater effect on alar base reduction compared to the conventional technique. In contrast, our study achieved not only a reduction in scarring but also a significantly greater decrease in alar width.

A recent comparative analysis of post-ABR aesthetic outcomes[6] reported statistically significant improvements in reduction in interalar-to-intercanthal ratio (mean ratio decreased significantly from 1.07 (±0.11) to 1.04 (±0.08) (P < .001)), enhanced nostril symmetry, and decreased incidence of horizontally oval nostrils. These findings are highly congruent with our own results, which demonstrated superior anthropometric outcomes and preserved symmetry in the BFR-mattress group.

In a separate study investigating ABR complications, visible scarring was negligible in 75.6% of patients, noticeable but acceptable in 22%, and noticeable and unacceptable in only 2.4%. Asymmetry was reported in 78% of cases, and alar rim notching in 2.4%[15]. Importantly, our study showed similar complication frequencies between the conventional ABR and BFR-mattress groups, affirming that this modified technique does not elevate surgical risk despite its superior narrowing efficacy. A notable finding regarding the incidence of scarring in our patient was that the majority of the studied subjects had thick skin, which is a known factor for increasing the propensity for scar formation.

In this study, the evaluation of nasal obstruction after surgery was based solely on the patients' subjective scale, and no objective functional tests, such as rhinomanometry, were performed. Given concerns about external nasal valve dysfunction, objective measurements of airflow could substantiate the safety claim. Therefore, it is recommended that future studies utilize such tests to assess nasal obstruction.

Limitations and Technical Nuance

Although the BFR-mattress technique achieved significantly greater alar narrowing (mean Δ: 5.0 mm vs. 2.4 mm in the conventional group; P = 0.001), the procedure demands precise intraoperative modulation of suture tension. Over-tightening can lead to overcorrection, resulting in unnatural vertical nostril sill like cleft or potential compromise of the external nasal valve[11].

CONCLUSION

The bilateral facial repositioning technique using mattress sutures (BFR-mattress) achieves significantly greater reduction in the interalar-to-intercanthal ratio and superior aesthetic correction of nasal base width compared to conventional ABR in patients with objectively wide alar bases. The observed mean interalar distance reduction of 5 mm in the BFR-mattress group versus 2.4 mm in the control group (P = 0.001) confirms the technique's efficacy in addressing the prevalent issue of under correction, while maintaining an equivalent safety profile in terms of scar formation, nasal symmetry, and complication rates.

When interpreting the findings of this study, it is imperative to acknowledge that our investigation was conducted on a population of Iranian and Middle Eastern descent, demographic groups which typically exhibit a wider alar base.

It is recommended that this study be replicated across diverse ethnic populations and in multiple centers to more accurately determine the efficacy and outcomes of this technique.

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This study was approved by the Research Ethics Committees of Hamadan University of Medical Sciences (Ethics Code: IR.UMSHA.REC.1403.761) and was registered in the Iranian Registry of Clinical Trials (IRCT20250123064494N1).

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest to disclose.

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