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ORIGINAL ARTICLE
Cosmetic

ORUS: Ultrasonic Ostemodeling for Body Contouring

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Background: An attractive waist–hip ratio leads to a favorable aesthetic appearance in women and can be achieved through the *osteo remodelación ultrasónica simplificada* (ORUS) technique, which consists of the controlled fracture of the floating ribs through a small incision in the back based on an umbrella's functioning (open-semiclosed).

Methods: The ORUS technique was performed on 120 patients between 18 and 50 years of age. Patients were grouped according to the surgical procedure performed: ORUS (11 patients), ORUS + liposuction (n = 87), and ORUS + abdominoplasty (n = 22). Demographic and clinical preoperative and postoperative data were recorded in all patients included. Measurements of waist–hip index and body mass index were done in centimeters, and at 90 days, a computed tomography with 3-dimensional reconstruction was indicated.

Results: The surgery time depended on the procedure and varied from 30 minutes in the ORUS procedure to 180 minutes when it was combined with an abdominoplasty. A waist reduction was achieved with median preoperative measurements ranging from 89.0–110.0 to 65.0–69.0 cm depending on the procedure. The size of the incision did not exceed 1.2 cm, and only 2 patients had symptomatic atelectasis. The median total Body-QoL score ranged between 97 and 99 points from a maximum of 100 points.

Conclusions: The proposed ORUS technique achieved a waist and waist–hip index reduction with minor complications, a minimum scar, and a high satisfaction level.
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INTRODUCTION

Beauty standards have undergone changes in past years. However, the waist–hip ratio has remained one of the physical indicators that demand the most attention from women,[1] with a high expressiveness of their femininity, health, and fertility. Changes in lifestyle such as lack of exercise, consumption of high-calorie diets, and multiple pregnancies have caused the loss of that attractive waist–hip ratio.[2]

An attractive waist–hip ratio between 0.65 and 0.70 is part of body sculpting to achieve a more favorable aesthetic appearance in women and can be achieved through surgical or nonsurgical procedures.[3] Among the latter, the removal and fracture of ribs stand out for their lower risk and more favorable aesthetic results.[4,5]

The proposed ultrasonic ostemodeling *osteo remodelación ultrasónica simplificada* (ORUS) technique consists of the controlled fracture of the floating ribs through a small incision in the back with the use of a piezotome. The technique is based on umbrella functioning (open-semiclosed) (Fig. 1) by fracturing the 11th and 12th ribs, the muscular support on them is eliminated, and the diameter of the waist decreases because the muscles will rest on the next rib (10th). In essence, the muscle is forced to follow the modified position of the rib as if closing an umbrella. (**See Video 1 [online],** which displays the introduction to the technique explained with 3-dimensional [3D] simulation.) The objective of this article is to describe the technique and to present a case series study showing the results of patients who underwent 11th and 12th rib fractures for aesthetic purposes, combined with other elective cosmetic procedures.

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PATIENTS AND METHODS

A case series study with the implementation of the ORUS technique was designed by a plastic surgeon in Mexico during 2018–2022 (**Video 1 [online]**). (**See Video 2 [online],** which shows how to make the preoperative marking for the surgery.) (**See Video 3 [online],** which demonstrates the technique step by step to perform the surgery correctly.) (**See Video 4 [online],** which displays an animation explaining the zero rate of reported adverse effects.)

A total of 120 patients were included and grouped according to the surgical aesthetic procedure performed: ORUS (11 patients), ORUS + liposuction (n = 87), and ORUS + abdominoplasty (n = 22). Demographic and clinical pre- and postoperative data were recorded in all patients included. Except for 1 patient, all were women, between 18 and 50 years, with discomfort in their body contour. The exclusion criteria were a history of rib surgery, altered preoperative examinations, elevated anesthesiology risk, and psychiatric illnesses.

Takeaways

Question: This study aimed to assess the safety, efficacy, and patient satisfaction of the *osteo remodelación ultrasónica simplificada* (ORUS) technique, an innovative ultrasonic rib modeling approach for enhancing waist–hip ratios in women seeking body contouring.

Findings: Our research involved a case series of 120 patients undergoing the ORUS technique, with or without additional cosmetic procedures, demonstrating significant waist reduction, minimal complications, and high patient satisfaction, as evidenced by pre- and postoperative anthropometric measurements and Body-QoL scores.

Meaning: The ORUS technique offers a promising, minimally invasive option for women seeking to improve their waist–hip ratio with high satisfaction and minimal risk of complications.

Matarasso Classification

There are various classifications to determine the surgical approach based on anatomical criteria. Among them, Matarasso,[6] in his article published in 1996 "Classification and Patient Selection in Abdominoplasty," describes the following 4 categories with criteria related to skin laxity, muscle-fascial flaccidity, and recommended treatment[6]:

Type I

- Skin: minimal laxity
- Fat: variable
- Musculofascial system: minimal flaccidity
- Treatment: suction-assisted lipectomy

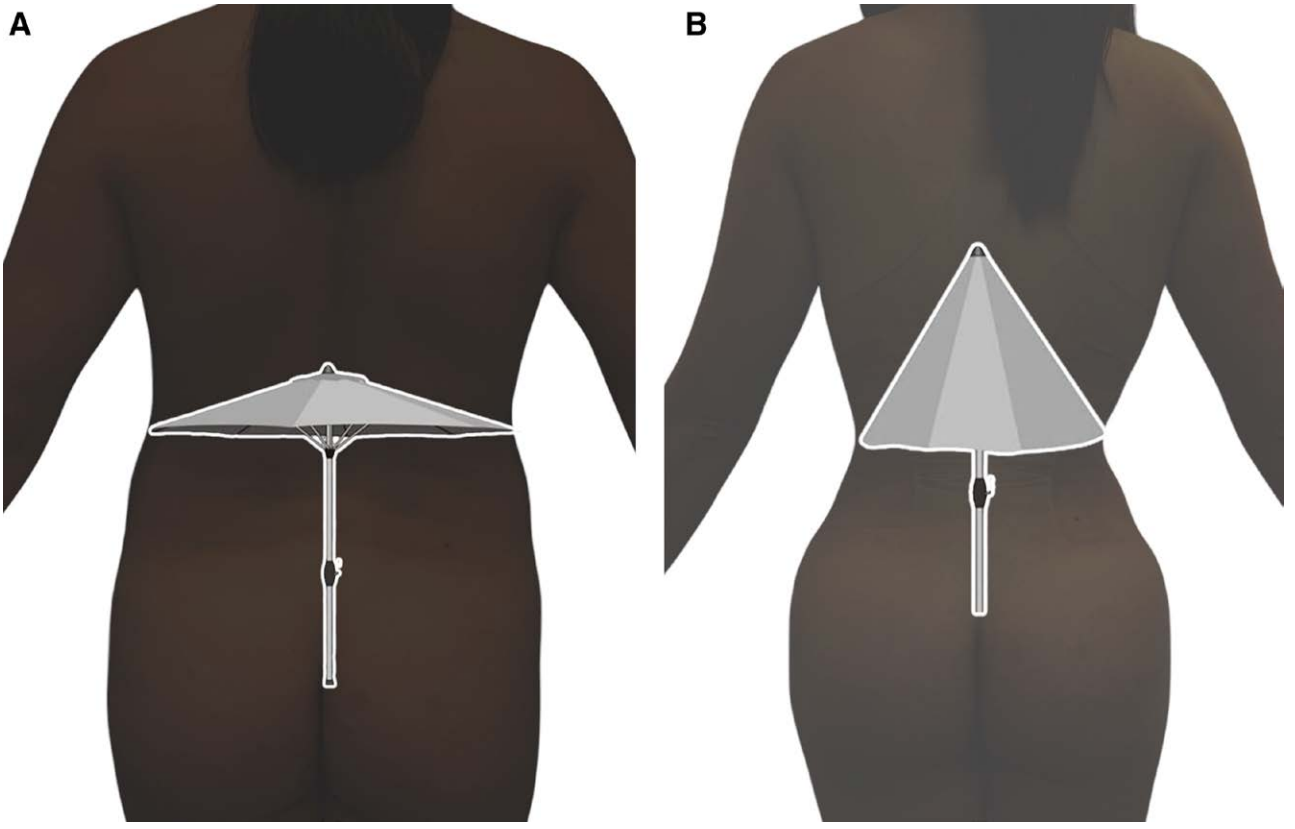

Fig. 1. Photograph of the proposed technique based on beach umbrella functioning. A, Fully open beach umbrella. B, Partially closed beach umbrella.

Type II

- Skin: mild laxity
- Fat: variable
- Musculofascial system: mild lower abdominal flaccidity
- Treatment: miniabdominoplasty

Type III

- Skin: moderate laxity
- Fat: variable
- Musculofascial system: moderate lower and/or upper abdominal flaccidity
- Treatment: modified abdominoplasty

Type IV

- Skin: severe laxity
- Fat: variable
- Musculofascial system: significant lower and/or upper abdominal flaccidity
- Treatment: standard abdominoplasty with or without suction lipectomy

In the first appointment, patients received a detailed explanation of the procedure. The physical examination included weight, height, waist, and hip measurements. Waist circumference was measured at the narrowest part of the body between the ribs and the iliac crest, whereas hip circumference was measured at the level of the maximum projection of the buttocks. Calculation of waist–hip index (WHI) and body mass index (BMI) was done. Preoperative laboratory findings included a complete blood count, blood chemistry, coagulation, and inflammatory markers. CT with 3D tomographic reconstruction was indicated before the intervention to identify pathological issues such as the presence of scoliosis, postural problems, an irregular number of ribs, dwarf ribs, or previous fractures.

Surgical Procedure

All patients underwent general anesthesia along with the following intravenous medications: antibiotic prophylaxis with cephalexin (2 g intravenous 60 min before incision). All patients were subjected to protocols for thromboembolic event prevention, blood conservation, and hypothermia prevention. Both surgical planning and overall risk assessment were performed in collaboration with our anesthesiologist.

A scapular line is marked from the inner edge of the scapula while the patient is in the prone position. Using **Video 2 [online]** as a guide, the 11th and 12th ribs are identified, which is typically achieved with ease in most patients, and the trajectory is traced from the scapular line to the posterior axillary line. An incision less than 7 mm long is made on both sides of the scapular line. The dissection continues through the subcutaneous tissue, clamping with the Allis and assisted with an electroscalpel until reaching the first muscular plane. After passing the dorsal muscle, the role of the rhinoscope is important; they must be positioned just above the 11th rib, which is the first one we will dissect. Continuing the passage through the lumbar ileocostal and possibly the serratus posterior. It is very important not to damage the intercostal muscles as they can continue and damage the retroperitoneum. Always aspirate secretions with the Frazier. Dissect with the help of the index finger downwards just behind the muscles until reaching the 12th rib. With the rhinoscope, the corresponding ribs are visualized. Once the rib is exposed, a vertical line is made on the body of the rib to remove the periosteum. With the assistance of the piezoelectric tip, the rib is cut in 2 of 3 from dorsal to ventral and assisted with the Frazier No. 8 aspirator. Light lateral pressure is applied until the rib fracture is noted or a click is audible. At the end of both ribs on that side, the surgical site is filled with a solution, and a sustained Valsalva maneuver is performed by the anesthesiologist to check for the absence of bubbles indicating pleural perforation and symmetry of thoracic movement.

Fig. 2. Image of the recommended compression garment, front closure, with rib reinforcement and complementary bands.

The same procedure is performed on the contralateral side. Technical details are described in the video of the surgery (**Video 3 [online]**).

All patients treated with ORUS leave with a rigid corset of at least 6 progressive compression peripheral rods. For liposuction and abdominoplasty, a stage 1 compressive belt is used along with foam between the skin and belt. In the case of liposuction + ORUS or patients with abdominoplasty + ORUS, the order was (1) foam, (2) compressive girdle, and (3) corset.

Postoperative Management

1. Postoperative corset (Fig. 2): A satin, cotton, and spandex corset with 12 rigid guide bars, covering

from the inframammary fold to the suprapubic region. It features reinforced compression at the level of ribs 9–12 and a front closure, which is crucial for ensuring anterior–posterior compression. Otherwise, with a posterior closure, it exerts lateral–medial pressure and does not achieve the best result. This corset will be adjusted from the initial point according to each patient's tolerance, with our experience showing at least 2 size changes from the starting point. It will be worn for at least 8 weeks and/or until the control CT scan.
2. Epifoam: Placed between the skin and the compression garment to protect the skin from friction. It will be used for the same duration as the corset.
3. Highly moisturizing creams: Postpartum-type creams should be used for at least 3 months to keep the skin hydrated.
4. Lymphatic drainage: In cases of liposuction and/or abdominoplasty, manual lymphatic drainage was performed in all cases with at least 10 sessions starting the day after the surgery.

Burn Prevention

1. Constant irrigation: Maintain constant irrigation with saline solution during the use of the piezotome to dissipate heat and keep the tissues at a safe temperature.
2. Limitation of contact time: Avoid prolonged use of the piezotome at a single point. It is advisable to take frequent breaks and move the head continuously.
3. Device settings review: We verify the cutting power at maximum and the irrigation at 50%.
4. Constant observation: Any signs of overheating or thermal damage should be addressed immediately.
5. Postoperative protocols: Healing serum with epidermal growth factor, triticum vulgare, and/or silicone gels.

Scar Management

Regarding scars, currently, the scar in all cases measures 7 mm (Fig. 3), resulting in superior aesthetic outcomes. However, management includes epithelializing gels, silicone patches, and CO_2 laser. Attached is a photograph of the current scar 30 days postoperative (Fig. 3).

We include a photograph showing the current scar follow-up of the procedure, where we observe a female patient, 32 years of age, 30 days postoperative with a 7-mm scar and good evolution. Unfortunately, skin phototypes 3–4 show color changes that take longer to adjust to the natural skin tone.

Outcome Evaluation

At 60–90 days after surgery, a second CT with 3D tomographic reconstruction is indicated, and a validated scale for body contouring surgery (Body-QoL for high-definition lipoplasty) is applied. Questions were formulated in a Likert-basis model, and results were evaluated accordingly.

Statistical Analysis

The information was collected ensuring the appropriate organizational and ethical conditions. A database was created in the Excel format of Microsoft Office version XP, which was later exported to the SPSS version 21.0 system for analysis, where frequency distributions, percentage calculations, SD calculations, and measures of central tendency were carried out. All determinations were made taking into account $\alpha = 0.05$ to guarantee a reliability of these determinations of 95%. The results of the study will be expressed through tables and graphs for better understanding and analysis.

Fig. 3. Image of a scar, 1 month after surgery, measuring less than 7 mm.

Ethical Considerations

Each patient was informed of the purpose, methods, sources of funding, any possible conflicts of interest, institutional affiliations of the authors, anticipated benefits, potential risks of our study, and the discomfort it may entail and poststudy provisions and outcomes according to the Declaration of Helsinki.[7] They were also informed of the right to refuse to participate in the study or to withdraw consent to participate at any time without reprisal. A freely given informed consent was signed before surgery for each patient participating in our report.

RESULTS

A total of 120 patients were enrolled in our study; almost all patients were women (n = 119, 99.2%). The median age was 32.5 years (25–95 percentile). The

Table 1. Preoperative Clinical Variables of Patients

Variable	ORUS (N = 11)	ORUS + Liposuction (N = 87)	ORUS + Abdominoplasty (N = 22)
Age*, y	32.1	33.2	31.5
Hip†, cm	97 (88–107)	99 (85–110)	98 (86–109)
Waist†, cm	81 (70–94)	83 (71–96)	82 (72–94)
WHI†	0.84	0.86	0.85
BMI†	25.7	26.1	25.8

*Number (percentage).
†Median (10–90th).

Table 2. Operative Clinical Variables of Patients

Variable	ORUS (N = 11)	ORUS + Liposuction (N = 87)	ORUS + Abdominoplasty (N = 22)
Surgery time, min	30	90	180
Incision size, cm	1.2	1.2	1.2
General anesthesia*	11	83	22
Neuraxial block*	0	4	0
Postoperative waist, cm*	65	67	66
Postoperative WHI†	0.75	0.77	0.76
Postoperative BMI†	24.5	24.9	24.7

*Number (percentage).
†Median (10–90th).

median and percentile values of the anthropometric measurements were hip, 98 cm (86–109 cm); waist, 82 cm (71–95 cm); WHI, 0.85 (0.73–0.95); and BMI, 25.9 kg/m^2 (22.3–29.7 kg/m^2).

Table 1 shows the results of the main preoperative clinical variables of the patients included in the study, grouped according to the procedure performed. The mean age was similar between the groups. Anthropometric measurements showed variation according to the surgical procedure to which they were exposed. Vascular comorbidities were infrequent, and a sedentary lifestyle was notable. There was no history of cancer or cardiovascular diseases.

Table 2 shows the operative and postoperative variables of the patients included in the study.

The surgery time depended on the procedure and varied from 30 minutes in the ORUS procedure to 3 hours (180 minutes) when it was combined with an abdominoplasty. The values of postoperative anthropometric measurements collected 3 months after the procedure are also shown. The size of the incision did not exceed 1.2 cm, and general anesthesia was used in most patients except for 4 patients who were exposed to a neuraxial block.

Postoperative care was optimal in all patients included, and only 2 patients had symptomatic atelectasis as adverse effects. Complications such as seromas, surgical site infection, pneumothorax, hemothorax, respiratory complications, or chronic pain were not reported in the operated patients.

Supplemental Digital Content 1 represents the reduction in anthropometric variables in patients operated on using the 3 surgical techniques. (**See figure, Supplemental Digital Content 1,** which displays a photograph of the changes in anthropometric measurements. A, Reduction of the waist with surgical techniques. B, WHI differences with surgical techniques. C, BMI reduction with surgical techniques, **http://links.lww.com/PRSGO/D794**.) A marked waist reduction is observed, ranging between 7 and 26 cm loss with medians of 13 and 15 cm with the ORUS and ORUS + liposuction procedures, respectively. The difference in the WHI ranged between 0.08 and 0.32 depending on the procedure used. In the case of the reduction in BMI, it is more evident in the group of patients exposed to ORUS + abdominoplasty, which can reach 2.7 kg/m^2.

The Body-QoL questionnaire was answered by 120 (100%) patients who were at least 2 months postoperative. Postoperative results showed a median of more than 25 points, indicating that patients were very satisfied with the intervention in each subcategory of the survey: postoperative symptoms, self-perception, sexual life, and satisfaction with their body.

Supplemental Digital Content 2 represents the Body-QoL questionnaire score according to each surgical procedure. (**See figure, Supplemental Digital Content 2,** which displays a Body-QoL questionnaire score according to surgical technique group, **http://links.lww.com/PRSGO/D795**.) The median total score ranged between 97 and 99 points with a minimum of 88 points in a patient exposed to the ORUS + abdominoplasty procedure.

Pre- and Postoperative Images

Pre- and postoperative images of patients visually demonstrate the effectiveness of the ORUS technique in achieving significant waist reduction (Figs. 4–9).

DISCUSSION

The main purpose of aesthetic surgery is to achieve pleasant results that meet patients' desires. The shape of the body is determined by adipose fat distribution and

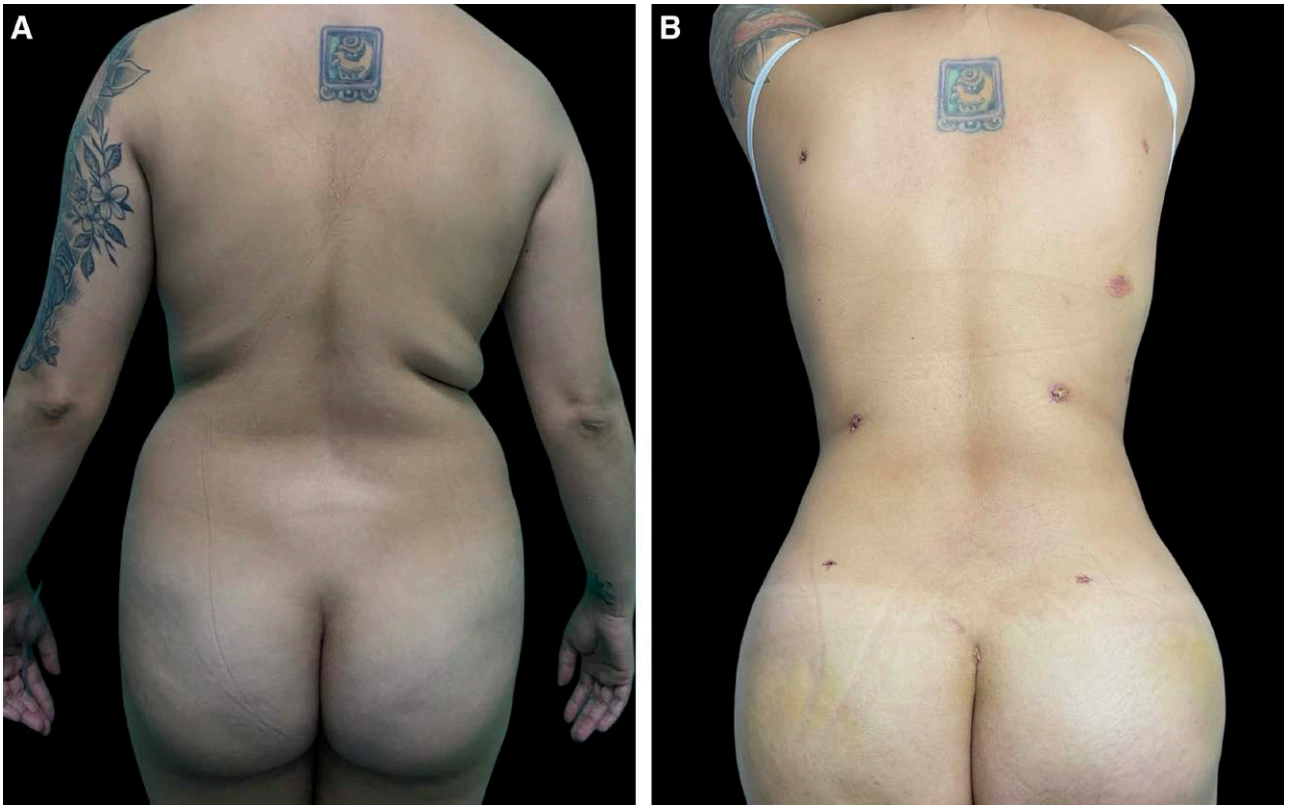

Fig. 4. Woman, 38 years, ORUS + abdominoplasty, preoperatively (A) and 2 months after surgery (B).

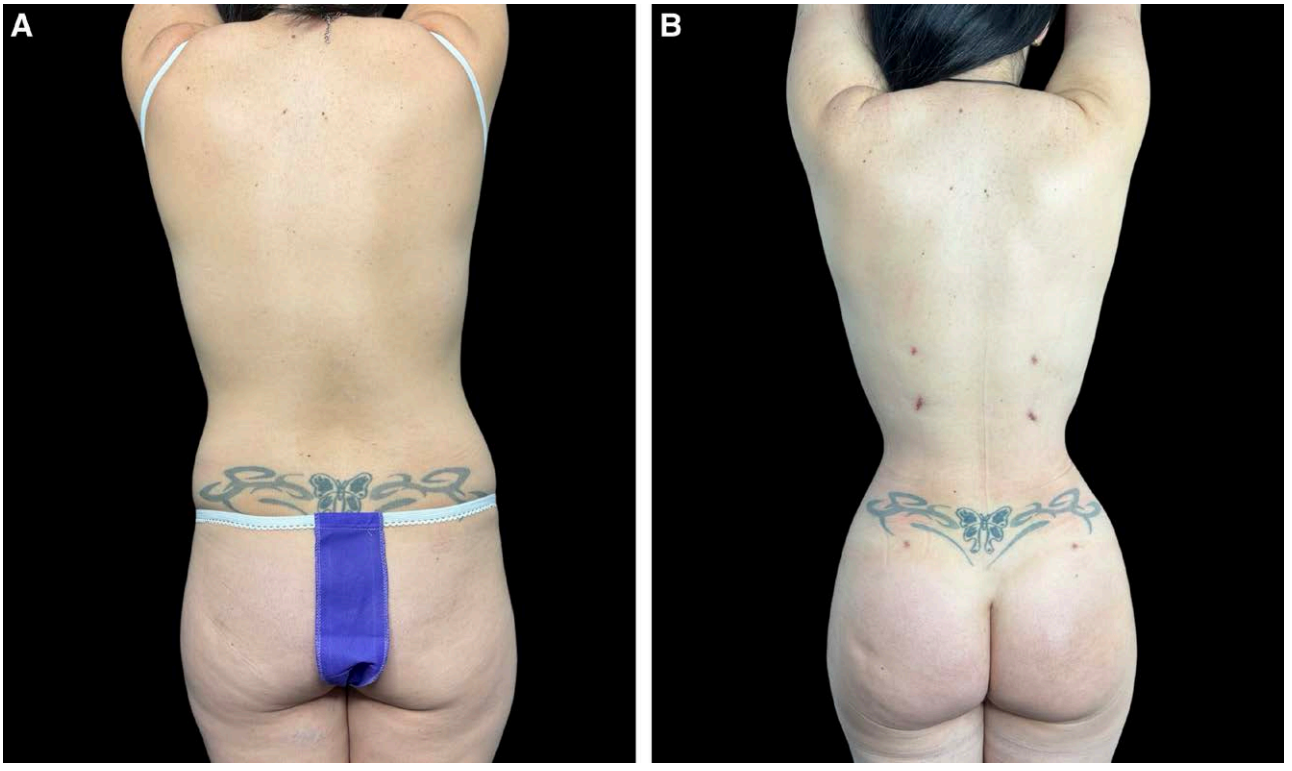

Fig. 5. Woman, 42 years, ORUS + liposuction, preoperatively (A) and 1 month after surgery (B).

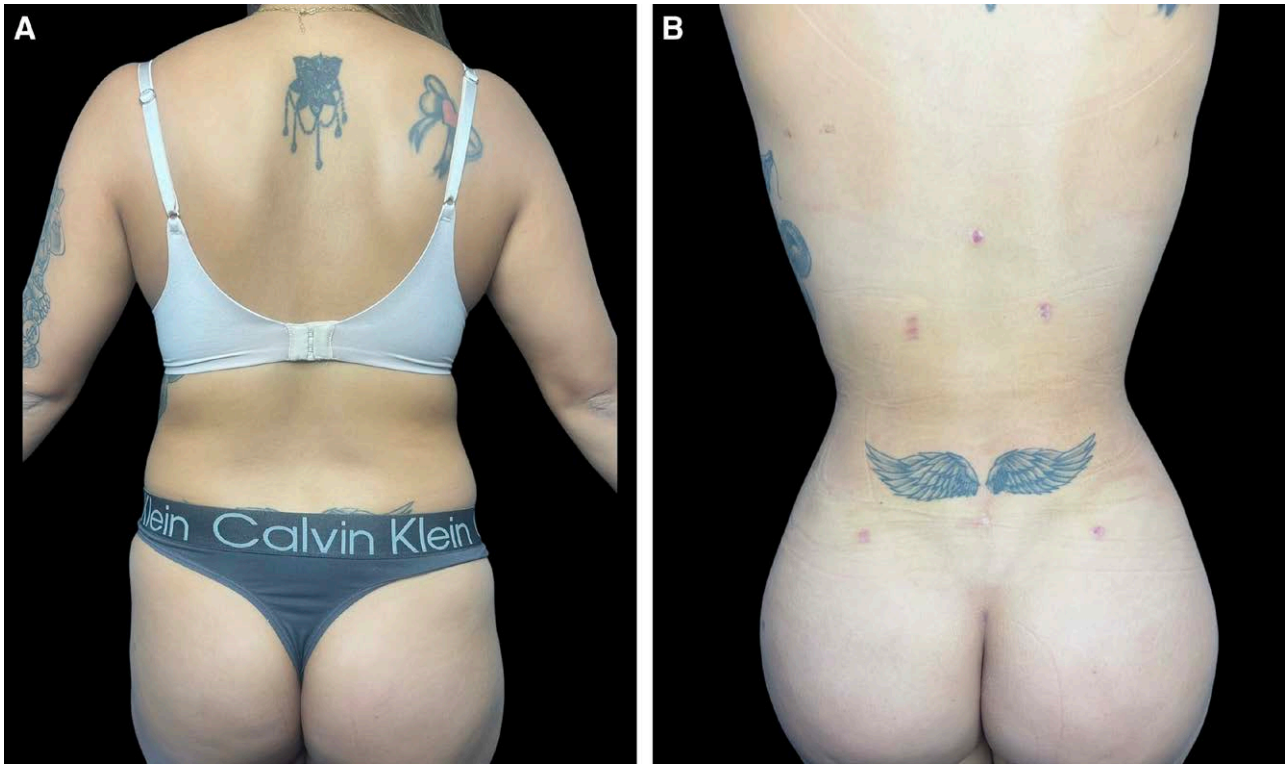

Fig. 6. Woman, 25 years, ORUS + liposuction, preoperatively (A) and 6 months after surgery (B).

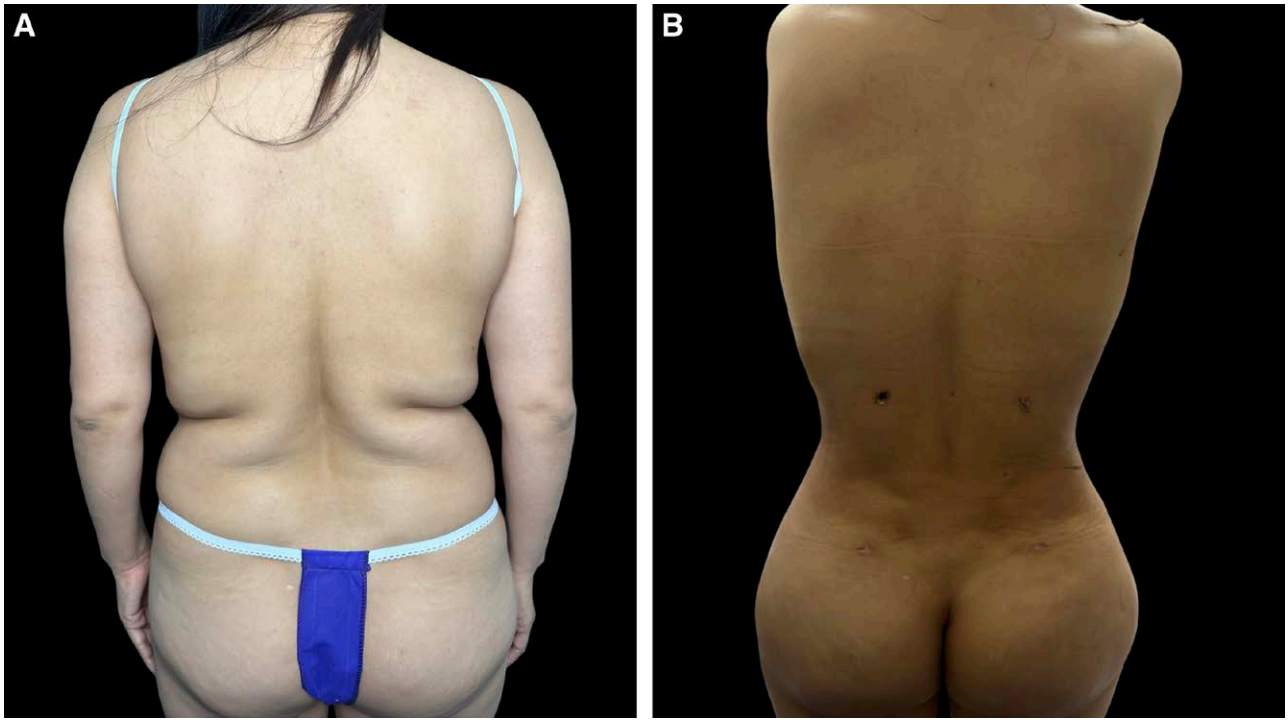

Fig. 7. Woman, 48 years, ORUS + liposuction, preoperatively (A) and 8 months after surgery (B).

skeleton shape. In women, the combination of a narrow waist with rounded hips is an important part of feminine beauty.

No more than 10 articles have been published related to body contouring surgery by rib modification.[8] Davison et al[9] exposed 5 transgender female patients to 11th and

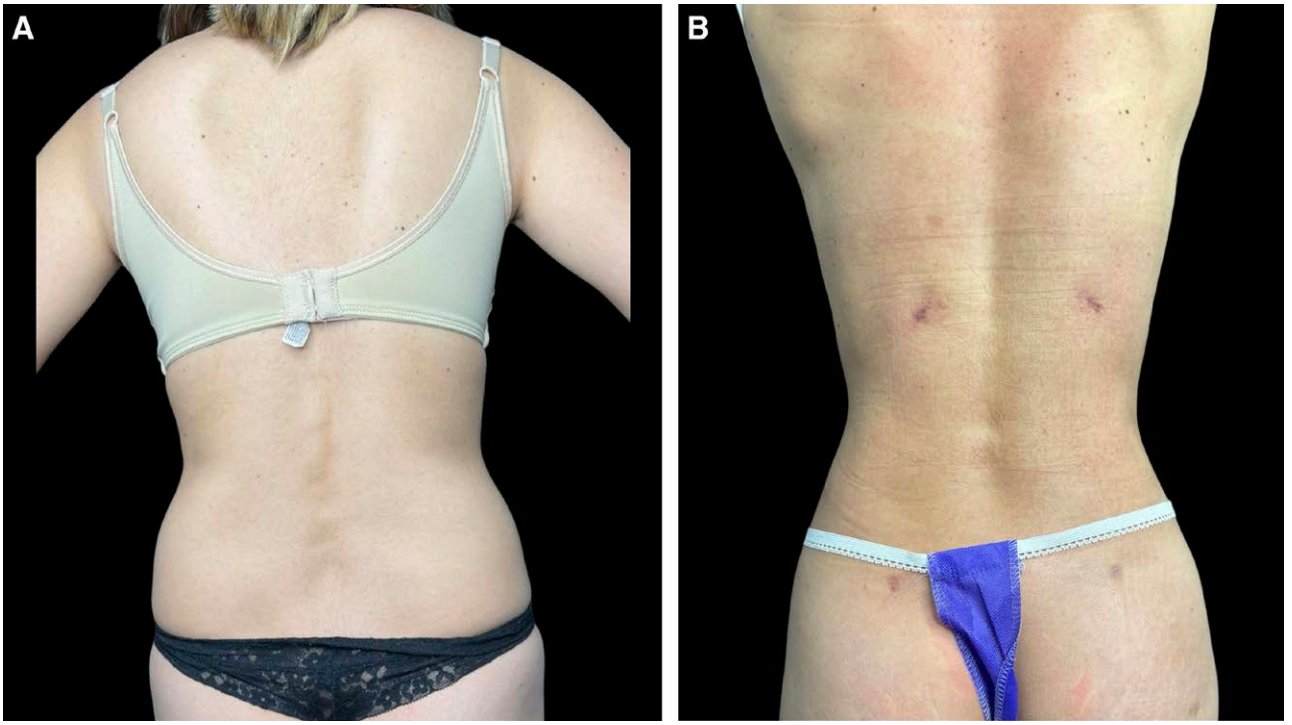

Fig. 8. Woman, 30 years, ORUS + liposuction, preoperatively (A) and 2 months after surgery (B).

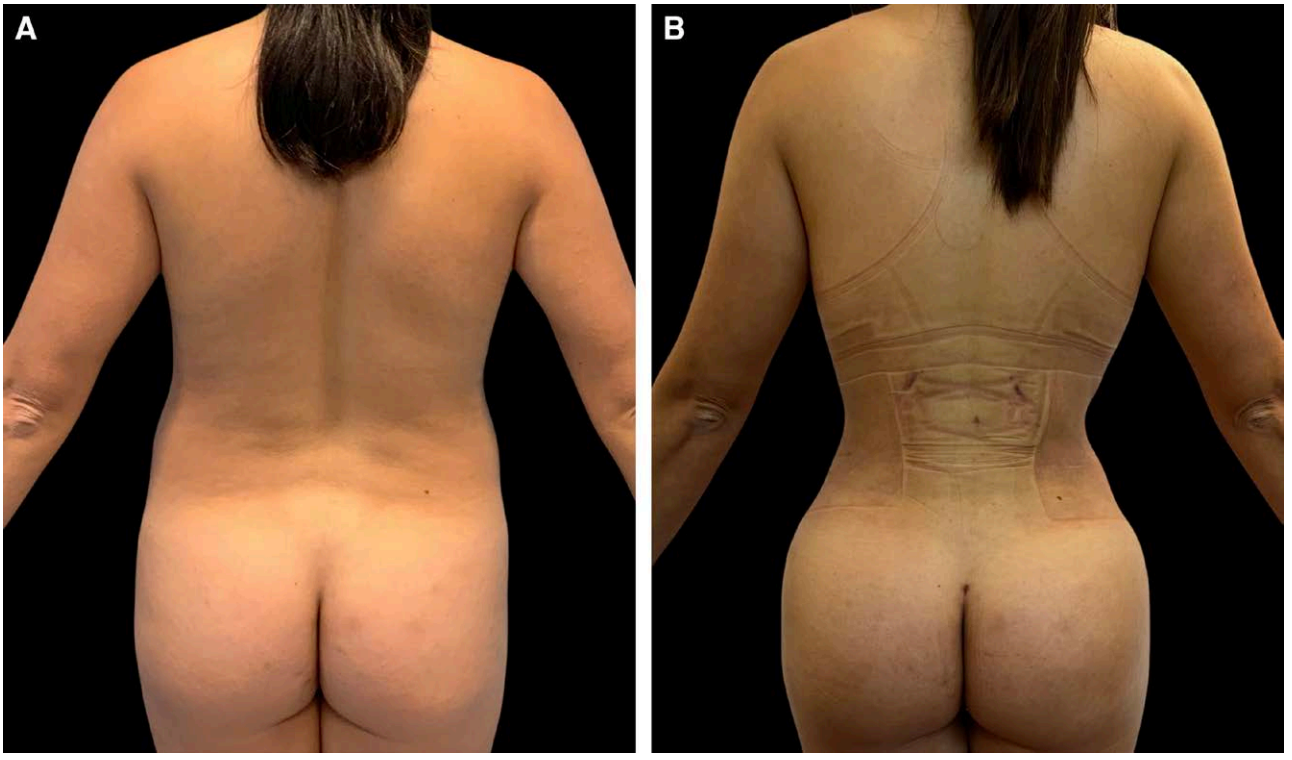

Fig. 9. Woman, 29 years, ORUS + liposuction, preoperatively (A) and 18 months after surgery (B). Reported continuing to use a compression garment for comfort.

12th rib removal surgery with the aim of narrowing the lower chest region and creating a more feminine silhouette. Verdugo[10] described the results of 104 women who underwent costal resection surgery in combination with liposuction, abdominoplasty, and breast implants, demonstrating that it is a useful technique with a low

complication rate. The removal of the 11th and 12th ribs allows for accentuating the waistline by increasing the space between the costal arch and the iliac crest.

A recent study carried out in Taiwan showed a 7.7% mean waist–hip ratio decrease in 5 patients who underwent removal of the floating ribs.[11] Rib resection was performed in an outpatient setting and no adverse events were observed, with a high degree of satisfaction.[12]

Waist narrowing without the removal of ribs has also been published as a technique for improving body contour. Kudzaev and Kraiushkin[13] operated on 93 patients for waist narrowing by means of a controlled fracture of the 11th and 12th ribs without their removal. The authors concluded that the method is atraumatic, has a short rehabilitation period, and provides an obvious clinical effect with an average waistline reduction of about 8.0 cm.[14,15]

In a recent study, 30 female patients were exposed to a scarless ultrasound-guided rib (RibXcar) technique that assessed the degree of angular variation of the fracture by ultrasound. Rib angular and waist measurements showed a sustained reduction over time. The authors performed a staggered fracture from the 10th to the 12th ribs following the oblique ("M") line to achieve a harmonious scarless transition, avoiding a choppy effect that could deform and create asymmetry in the hips.[16]

Rib remodeling by fracture is an alternative with a straightforward procedure, possibly with lower risks than rib removal, and highly favorable aesthetic results when performed by a skilled surgeon. It also avoids the removal of ribs, maintaining their role in protecting the internal organs and decreasing potential complications.

A follow-up of 3 months for the patients and the nonhomogeneity of the study groups are limitations to consider. Despite these limitations, the study demonstrates the effectiveness of the technique alone or combined for body contour management.

The ORUS technique is a minimally invasive surgical method of waist shaping with rib preservation. It is an atraumatic method with a short rehabilitation period, providing a marked clinical effect by changing the anatomy of the lower region of the rib cage, causing a larger contrast between the iliac crest and the waist. This technique is reproducible but requires precise anatomical knowledge and intense surgical training to achieve flawless execution and avoid major complications.

In our experience, we have not encountered complications such as pneumothorax, neuralgia, or respiratory restrictions. This is attributed to the following:

A. Why do we not have pneumothorax?

We use a safety line that does not exceed 60% of the rib depth. This is sufficient to create a greenstick fracture without penetrating deeper structures, thus preventing pneumothorax.

B. Why are there no neuralgias?

The subperiosteal dissection technique protects adjacent structures by separating the periosteum from the rib before fracturing. This method minimizes the risk of nerve damage, thereby preventing neuralgia.

C. Why are there no respiratory restrictions?

The remodeling process is progressive and depends on the use of the corset. This allows the lungs to adapt gradually, avoiding any sudden restriction in respiratory function.

These points are discussed in detail in an accompanying video (**Video 4 [online]**), which addresses specific questions and demonstrates the techniques used to prevent complications.

CONCLUSIONS

The proposed ORUS technique achieved a waist and WHI reduction with minor complications, a minimum scar, and a high satisfaction level in almost all included patients.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

Patients provided written consent for the use of their images.

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