

# Ultrasonic- and Ultrasound-assisted Improvement of Silhouette of the Torso: Bone Structure High-definition Remodeling (Part I)

Carlos Oñate Valdivieso, MD\*

Daniel Oñate Valdivieso, MD\*

Alfredo E. Hoyos, MD††

Mauricio E. Perez Pachon, MD§¶

Hugo Aguilar Villa, MD||

Paulo Jr Alberton Michels, MD\*\*

Andres Viera, MD††

Jorge E. Benavides, MD††§§

Silvia J. Villabona, MD¶¶

Brian Ramirez, MD|||

**Background:** High-definition liposculpture allowed plastic surgeons to achieve better aesthetic results by carving the underlying muscles and contours in a new way. Several authors have improved the original technique by adding other procedures and new technologies. We designed a new improvement by incorporating bone transformation surgery to overcome the lack of silhouette at the waist and, as a result, optimize the breast-waist-hip ratios.

**Methods:** We carried out a prospective multicenter study, with five different surgeons performing the same rib remodeling technique for waist definition. We used an ultrasonic piece for costal corticotomy and real-time ultrasound imaging to perform green-stick fractures over the last two or three floating ribs. Ours is a new technique based on the prior one described by Kudzaev.

**Results:** We reported 131 consecutive patients who were enrolled in this study. Waistline diameter decreased an average of 8cm after surgery ( $P < 0.05$ ). Most patients were women ( $n = 125, 95.4\%$ ). No major complications were reported. Most common complication was prolonged pain, with only three cases of contour asymmetry, all of which were attributable to noncompliance of constantly wearing the corset + compressive garments. Patients reported a high satisfaction rate and fast recovery (Body-QoL survey).

**Conclusions:** Ultrasonic- and ultrasound- assisted indentation surgery of the thorax is a safe and reliable technique for waistline definition, with a high satisfaction rate, almost-invisible scars, and minimal risk for complications. Incorporation of high-definition liposculpture to rib remodeling opens up a new horizon for bone structure modification surgery (S-high-definition remodeling) that can be safely performed for patients who seek better aesthetic outcomes in body contouring. (*Plast Reconstr Surg Glob Open* 2024; 11:e5513; doi: 10.1097/GOX.0000000000005513; Published online 10 January 2024.)

From the \*CIMA Clinic, Loja, Ecuador; †Total Definer, Bogota, Colombia; ‡Dhara Clinic, Bogota, Colombia; §Departments of Sciences and Research and Plastic Surgery, Total Definer, Bogota, Colombia; ¶Department of Surgery, Mayo Clinic; Rochester, Minn.; ||HAV Academy, Bucaramanga, Colombia; \*\*Private Practice, Brazil and UAE; ††Department of Plastic Surgery at Total Definer, Private Practice, Moscow, Russia; ‡‡TotalDefiner Medical, Bogota, Colombia; §§Private Practice, Bogota and Medellin, Colombia; ¶¶Department of Plastic Surgery at HAV, Clinica Fundacion Oftalmologica de Santander (FOSCAL), Bucaramanga, Colombia; and ||||Department of Epidemiology, Total Definer Medical, Bogota, Colombia.

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## INTRODUCTION

The technique for high-definition liposculpture (HDL) has evolved throughout the years by incorporating different artistic concepts, new technologies, and multiple approaches to protect the patient and therefore improve overall outcomes.<sup>1</sup> It emerged as an innovative surgical technique that rapidly spread around the globe, allowing plastic surgeons to achieve better aesthetic results by sculpting the underlying muscles in a different manner compared with prior lipoplasty methods.<sup>2,3</sup> Several authors have improved the original technique by adding not only innovative fat grafting techniques but also including excisional procedures.<sup>4–7</sup> As the popularity of body contouring procedures grows, more patients seek surgical and noninvasive procedures to achieve multiple

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aesthetic goals. Many are looking for a well-pronounced feminine silhouette in which the waistline plays a crucial role. The most common conventional body contouring procedures in the abdomen and waistline region include liposuction and tummy tuck. However, there is growing interest in the development of new procedures to further define the curvature of this region.

Acknowledging the role of the bony structure of the ribcage in the appearance of the waistline, previous authors described the rib removal technique as an aesthetic procedure to be used not only in transgender patients but also in cisgender women.<sup>8</sup> By increasing the space between the patient's ribcage and iliac crest, the hip-to-waist ratio is accentuated. Looking for better results in waistline definition through a less invasive approach, Kudzaev and Kraiushkin described a rib remodeling technique through osteotomy by accessing the 11th and 12th ribs through a 2-cm long incision at the scapular line on both sides. Then, green-stick fractures were done over the ribs, and patients were put in a corset for 2 months.<sup>9</sup> Bone studies have shown that ribs have more osteons and higher bone formation rates compared with other bones such as the femur.<sup>10</sup> Therefore, ribs are able to respond to micro-damage more easily and heal through reparative remodeling.<sup>11</sup> Although using green-stick fractures to remodel the ribs is less invasive than surgically excising bone from them, it is not without major risks including injury to the underlying pleura and lungs. Strategies used to minimize risks include less invasive methods and muscle-sparing access combination approaches, together with a relaxed position of the arm (avoids ribcage overexposure).<sup>12</sup>

Rib reshaping techniques for reconstructive purposes have been extensively explored and documented, mostly focused on restoring the natural contour of the thorax in its anterior and lateral aspects. However, the incidence and progression of rib fractures showed that lateral fractures within the mid portion of the rib were associated with a higher complication rate compared with that from other sites.<sup>13</sup> The aim of incorporating these techniques into cosmetic surgery is to mitigate risks, ensure inconspicuous incisions, and enhance the aesthetic outcomes. This integration seeks to minimize surgical evidence while maximizing the achievement of patients' aesthetic goals. As a result, one of the most recent improvements we have made to high-definition body contouring is the addition of bone remodeling surgery to overcome the lack of silhouette over the waist and optimize the breast-waist-hip ratios (Fig. 1). We aim to describe our technique for waist definition, the ultrasonic- and ultrasound-assisted indentation surgery of the thorax (UUAIST) (based on Kudzaev's), by using an ultrasonic piezotome (Cube 2022; FINAPOLLINE, Merignac, France) for corticotomy and real-time ultrasound (US) imaging for intraoperative assessment. We will also evaluate the impact of the outcomes through a validated body satisfaction score.<sup>14</sup>

## METHODS

We conducted a prospective multicenter study, involving five different surgeons who were trained to perform

### Takeaways

**Question:** Can plastic surgeons change the waistline definition in women with a wide torso and/or with thin body shapes?

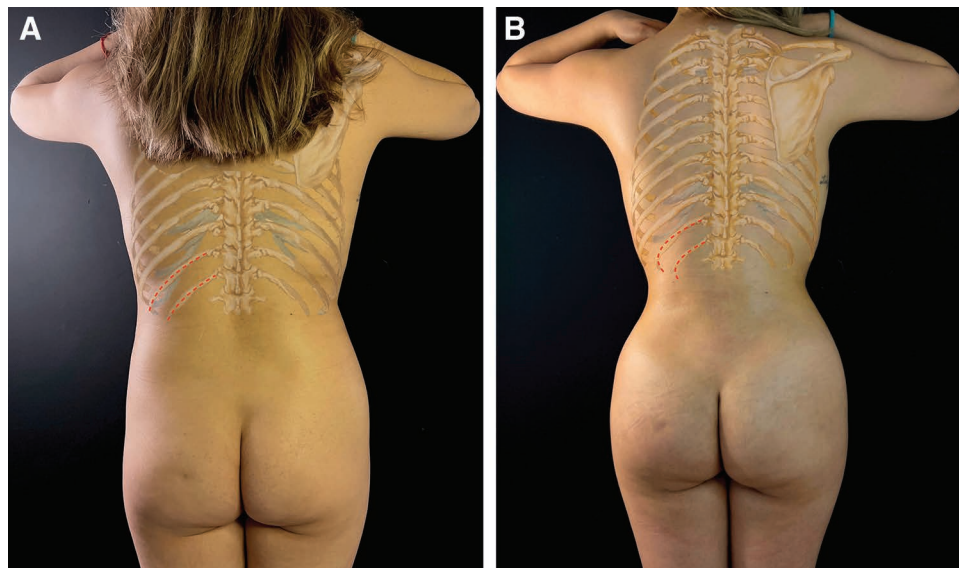
**Findings:** We carried out a prospective study to evaluate and improve the rib corticotomy technique for waist reshaping. Five different surgeons within five different centers were trained in Kudzaev's technique for waist definition without rib removal. We reported a cohort of 131 women who underwent waist definition surgery by performing rib corticotomy with an ultrasonic piezotome and green-stick fractures afterward. In addition, real-time ultrasound imaging helped to assess every step of the procedure (ultrasonic- and ultrasound-assisted indentation surgery of the thorax). A validated survey showed the great satisfaction index with very low rate of complications.

**Meaning:** Rib remodeling surgery is a safe and reproducible procedure that can be done for women who want a better definition of their waistline.

the same rib remodeling technique for waistline definition through minimal stealth incisions. Participating centers were located in Loja, Ecuador (C.O. and D.O.), Bogota and Bucaramanga, Colombia (A.E.H., M.E.P.P., and H.A.V.), Dubai, UAE (P.A.M.), and Moscow, Russia (A.V.). All procedures were carried out in a hospital setting. Inclusion criteria were healthy patients who underwent rib remodeling procedures with or without any other body contouring procedure, except rib resection. Exclusion criteria were patients with a waist-to-hip ratio  $\geq 1.6$ , patients with ASA score greater than II, patients with any uncontrolled chronic illness, patients with medical history of diabetic mellitus, metabolic syndrome, prior ribcage fractures, blood clotting disorders or any other illness related to them, body mass index (BMI) greater than  $32 \text{ kg/m}^2$ , and active smokers or those with less than 30 days from quitting. Patients were enrolled at each center by the main surgeon, and a unique database was used for all centers. All patients were followed up for at least 3 months. Photographic records were taken before surgery and during follow-up appointments at 2 days and 1, 3, and 6 months.

### Preoperative Evaluation

Thoracic high-resolution computed tomography (CT) scan with 3D reconstruction was done for preoperative planning. Rib length, symmetry, and number of ribs involved in the waistline shape (long versus short torso) were all assessed to determine which of them should be intervened (Table 1). During the initial appointment, patients received a detailed explanation about the procedure and what to expect based on individual anatomy. Physical examination included measurements at the waist, hips, and breasts (in some cases) and an osteomuscular examination for body contouring surgery. 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. Preoperative laboratory findings included complete blood count, D dimer, prothrombin



**Fig. 1.** Comparison of the waistline diameter and simulated osteochondral structure of a 38-year-old woman who underwent UUAIST. Ribcage structure in a patient with a prior waist-to-hip ratio of 1:1.2 (A) and a new waist-to-hip ratio of 1:1.6 about 3 months after surgery (B). The red dotted lines show the difference in the floating ribs structure.

**Table 1. Criteria for Rib Intervention Based on CT Scan Evaluation**

Criteria	Conduct per Rib
Standard intervention*	10, 11 (BL)
Short 12th rib(s) ( $\leq 7$ cm)	10, 11 (BL)–12 (UL or BL)†
Short torso	10, 11, 12 (BL)†
Long projection of 10th rib(s) ( $\geq 10$ cm) in long torso	10, 11, 12 (BL)†
Long projection of 11th rib(s) in both short and long torsos	10, 11 (BL)†

Conduct on rib intervention will depend on anatomic features and symmetry of the ribs (mainly 12th rib)

The procedure has to be also adjusted to the curvature of the spine: mild and moderate scoliosis might need an asymmetric intervention as well.

\*Verify the symmetry and presence of both 12th ribs (rule out rib agenesis).

†UL and BL will depend on symmetry and length of the ribs.

BL, bilateral; UL, unilateral.

time, partial thromboplastin time, total protein, albumin, and C-reactive protein. Both surgical planning and overall risk assessment were performed in collaboration with our anesthesiologist.

### Surgery

All patients underwent general anesthesia along with the following intravenous (IV) medications: antibiotic prophylaxis with cefazolin (2g IV, 60 minutes before incision-before entering the operating room) or clindamycin 600mg IV (If allergic to beta-lactams), dexamethasone 8mg, metoclopramide 10mg, diclofenac 50mg, and ranitidine 50mg. All patients were subject to protocols for thromboembolic events prevention, blood conservation, and hypothermia prevention.<sup>15–17</sup> The patient was positioned in decubitus prone with shoulders at 90-degree abduction and external rotation. Decubitus supine was used as per HDL needs.

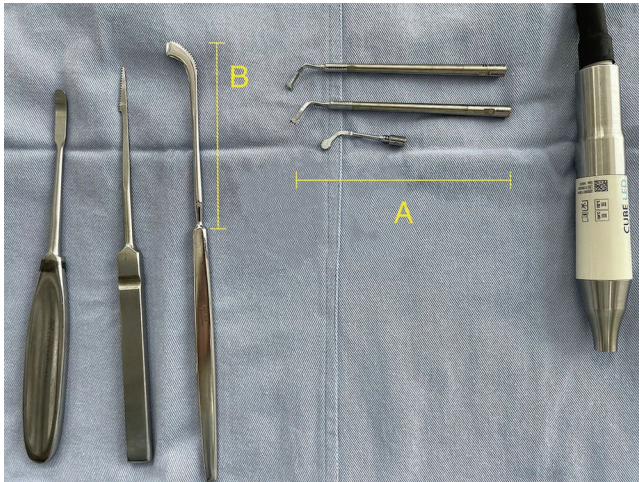
### HDL Procedure

1. Markings were all done in the standing position based on the desired degree of muscular definition for each patient.<sup>3</sup>
2. Dynamic-definition liposculpture was achieved by a three-step process:

- Infiltration: Tumescent solution (1000 mL of saline and 1mL of 1:1000 epinephrine) + lidocaine (10mg/kg) only for liposuction of the arms.
- Fat emulsification: Third-generation US (VASER Lipo System, 2021 Solta Medical; Bausch Health Companies Inc., Bothell, Wash.) in pulsed and continuous modes at 50%–60% power for the superficial and deep adipose layers, respectively.
- Microaire-assisted liposuction (2020 MicroAire Surgical Instruments, LLC, Charlottesville, Va.) with 3.0- and 4.0-mm Mercedes cannulas. We did deep debulking when necessary (most women), and superficial plus intermediate layer liposuction for detailed muscular definition (based on the Basic, Moderate, Xtreme definition algorithm).<sup>8</sup>

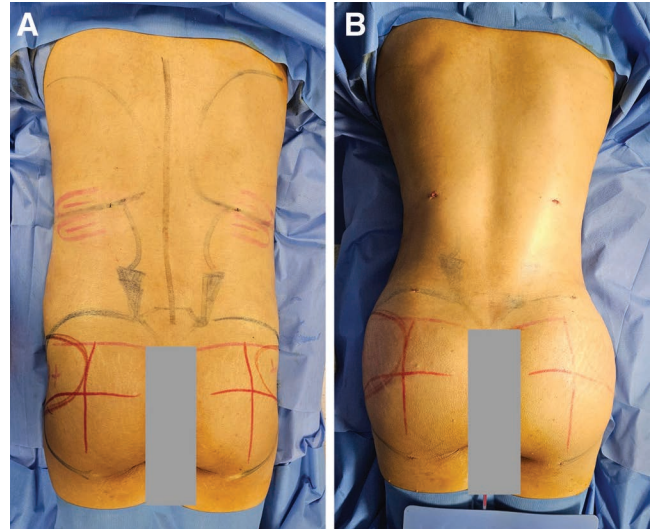
### Rib Remodeling Procedure

CT measurements guided the marking of ribs for intervention (10th–11th–12th). A protective gel pad was placed below the patient at the level of the anterior superior iliac spines. We marked the midline (vertebral spinous processes) and measured 7cm laterally on each side to draw a parallel line (medial access). This generally coincided with the internal border of the scapula. Asymmetric incisions were done at the level of the ribcage border for lateral access ( $\approx 10$ – $12$ cm lateral to the midline) depending on surgeon's preference. Ribs for intervention were



**Fig. 2.** Manual and powered tools used for UUAIST. A, The tip of the piezotome must be long enough to access the ribs for intervention. B, A Tastan-Cakir manual saw tool can be also used for this purpose.

identified by palpation and US (if necessary). [See Video 1 (online), which shows real-time US imaging for intraoperative markings and mapping.] We used the US to also perform a nerve block with local anesthetics (1% lidocaine + epinephrine 10–20 mL). Half the amount was used for blocking and the other half for cortical bone infiltration. One 3- or 4-mm incision was done at the level of the 10th rib on one side (eg, left) and another incision at the level of the 12th rib (eg, right). Just these two asymmetric incisions were enough to give access to two or three of the floating ribs. The surgeon ensured that the tip of the piezotome (or hand sawing tool) was long enough to access the ribs for intervention (Fig. 2). A Joseph 4-mm periosteal elevator was used to peel the ribs. [See Video 2 (online), which shows ultrasonic- and ultrasound-assisted improvement of silhouette of the torso.] Palpation and US were both used to ensure a proper exposure of the corticotomy site. Then, the ultrasonic piezotome (Cube, 2022 FINAPOLLINE) was utilized for costal corticotomy and real-time US imaging to ensure the cut the superficial cortex of each rib until a depth of 3–4mm is reached. A constant and perpendicular compression over the longitudinal axis of the rib was performed until hearing the snap from green-stick fracture [see Video 2 (online)] Each surgeon verified the fracture of the ribs either by US scanning and/or palpation. The patient was held by their hips to evaluate the resultant waist diameter and symmetry. Reduction must be evident (Fig. 3). Incisions were closed with an intradermal butterfly suture to reduce the final length of the wound. Patients were dressed up in postoperative compressive garments and UUAIST corset immediately after surgery. [See figure, Supplemental Digital Content 1, which shows corset for postoperative compression (right) (sizes S, M, and L), and fracture consolidation (left) (unique size), <http://links.lww.com/PRSGO/C996>.] [See figure, Supplemental Digital Content 2, which shows common postoperative garments for HDL with (top) and without definition of the arms (bottom) can be worn together with the supportive garment for fracture consolidation, <http://links.lww.com/>



**Fig. 3.** Female patient: 34 years old. A, Preoperative photograph shows the markings for HDL and rib corticotomy. B, Immediate postoperative photograph shows the evident decrease of the waist diameter.

**PRSGO/C997.**] HDL postoperative protocols for patient active recovery were followed. Soft massage and lymphatic drainage were done as per patient tolerance.

#### 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 (Fortaleza 2013). 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.

#### Outcome Evaluation

Patients answered a validated scale for body contouring surgery (Body-QoL for high-definition lipoplasty)<sup>14</sup> within 3–6 months postoperative. Questions were formulated in a Likert-basis model and results were evaluated accordingly.

#### Statistical Analysis

Mann-Whitney U tests were used for nonnormal distribution to determine the preoperative versus postoperative differences. Outcomes were tested to a significance level of 5% ( $P \leq 0.05$ ). *Jamovi* (version 2.3, computer software, retrieved from <https://www.jamovi.org>) was used for statistical analysis.

## RESULTS

A total of 131 patients were enrolled in our study. Almost all patients were women ( $n = 125, 95.4\%$ ). Mean age was 33.8 years old (SD = 6.92 y). Mean height was 1.65

**Table 2. Demographic Data and Medical History from Patients Who Underwent UUAIST Procedure**

Information	Mean, n	Percentage or SD
Female	125	95.4%
Male	6	4.6%
Transgender*	9	7.2%
Age (y)	33.8	6.92
Height (m)	1.65	0.07
Weight (kg)	61.7	8.1
BMI (kg/m <sup>2</sup> )	22.6	2.59
Race		
Latino	65	50%
White	61	46.9%
Asian	4	3.1%
<b>Personal History</b>	<b>n</b>	<b>Percentage</b>
Disease		
None	125	95.4
High blood pressure	3	2.3
Cancer	1	0.8
Dyslipidemia	1	0.8
Hypertrophic scarring	1	0.8
Surgical (previous liposuction)		
None	24	18.3
1	45	34.4
2	43	32.8
3	19	14.5

\*Transgender patients are not depicted as additional patients, but rather a percentage of the total population.

m (SD = 0.07 m). Mean body weight was 61.7 kg (SD = 8.1 kg). Mean BMI was 22.6 kg/m<sup>2</sup> (SD = 2.59 kg/m<sup>2</sup>). Out of the 131 patients, 65 were Latino (46.9%), whereas White and Asian races accounted for 61 (46.9%) and four (3.1%), respectively. Medical history included hypertension (n = 3, 2.3%), cancer (n = 1, 0.8%), hypertrophic scarring (n = 1, 0.8%), and dyslipidemia (n = 1, 0.8%). A significant proportion of patients had undergone a prior liposuction (81.7%), whereas only 24 patients (18.3%) had no prior surgical interventions (Table 2).

The overall intervention had a median duration of 180 minutes [interquartile range (IQR): 70 min]. Rib procedures alone had a median of 50 minutes depending on the number of ribs intervened. Among surgical procedures, UUAIST alone was the most common (48.8%), followed by UUAIST + HDL (21.1%). Detailed information about other procedures is included in Table 3. Technologies for skin tightening, fat grafting, and other additional procedures are included in Table 4. Preoperative waist measurement had a median of 72 cm (IQR: 6 cm), whereas the

**Table 3. Distribution of Frequencies from the Different Types of Procedures**

Type	Patients	Percentage
UUAIST (alone)	60	48.8
UUAIST + HDL	26	21.1
UUAIST + HDL + abdominoplasty	16	13
UUAIST + HDL + fat grafting	15	12.2
UUAIST + HDL + abdominoplasty + muscle plication	6	4.9

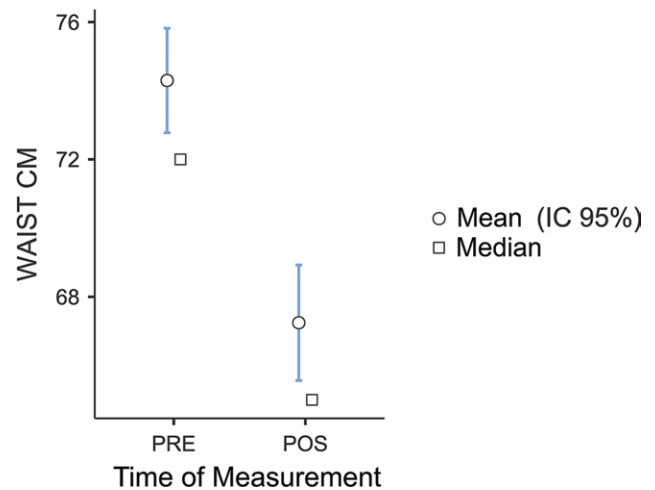
**Table 4. Distribution of Frequencies from Additional Procedures and Technologies Used for Skin Tightening of Patients Who Underwent UUAIST Procedure**

Additional Procedures	Patients	Percentage
Techniques		
Buttocks fat grafting	52	39.7
RAFT	43	32.8
SPARTAN	19	14.5
Breast augmentation with implants	15	11.5
Breast fat grafting	10	7.6
Technologies		
Microaire	84	64.1
VASER	82	62.6
Renuvion	16	12.2
Morpheus 8	11	8.4
BodyTite	3	2.3

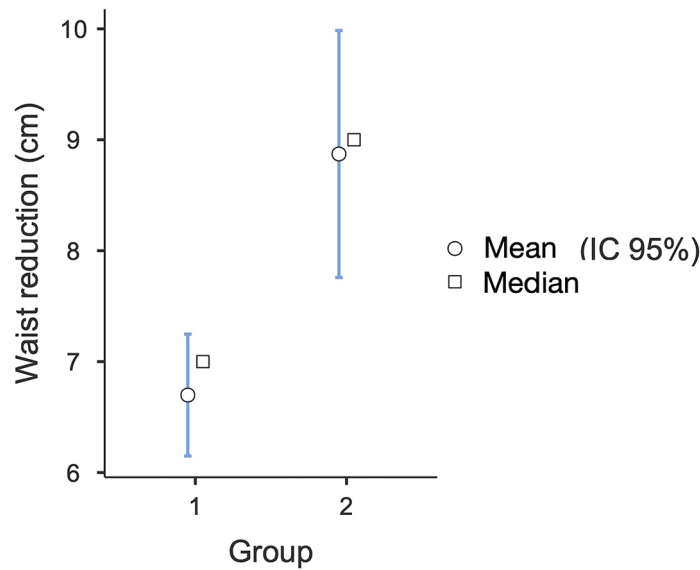
RAFT, rectus abdominis fat transfer; SPARTAN = serratus and oblique muscles complex fat transfer.

postoperative measurement at 3 months had a median of 65 cm (IQR: 5 cm). The median difference in waist circumference was 8 cm (IQR: 4.5 cm), and the difference between preoperative and postoperative measurements was statistically significant (Mann-Whitney U test, *P* < 0.001) (Fig. 4). Subsequent comparison between patients who underwent rib remodeling only (group 1) versus patients who received rib remodeling + liposuction + other procedures (group 2) showed that the median waist measurement reduction in group 1 was 7 cm with an IQR of 3 cm, whereas in group 2, it was 9 cm with an IQR of 4 cm. The differences between the two groups are statistically significant (Mann-Whitney U test, *P* < 0.001) (Fig. 5).

Few complications were reported; only three patients (2.5%) had residual contour asymmetry due to noncompliant use of the corset and garment. They entailed a prolonged use of the corset (4 months), but no additional procedures were required. In contrast, 9.1% of patients experienced



**Fig. 4.** Pre- and postoperative comparison of the mean measurement of the waist circumference. The difference was statistically significant for the mean and median values (Mann-Whitney U test, *P* < 0.001).



**Fig. 5.** Analysis between patients who underwent rib remodeling only (group 1) and patients who underwent rib remodeling + liposuction + other procedures (group 2). Differences were statistically significant (Mann-Whitney U test,  $P < 0.001$ ).

**Table 5. UUAIST and HDL\*Postoperative Complications**

Complications	Patients	Percentage
Contour asymmetry (ribcage/torso)	3	2.3
Severe postoperative pain	16	9.1
Chronic pain	1	0.8
Burn*	2	1.5
Seroma*	2	1.5
Excess skin*	1	0.8

\*Indicates that complications were related to high definition liposculpture but not to UUAIST procedure.

severe postoperative pain that required an increased dose of opioids. HDL-related complications included superficial skin burns (1.5%) treated with dressings and wound therapy, residual seromas (1.5%) treated with US and drainage, and one patient with excess skin who refused miniabdominoplasty in the first place (1%) (Table 5).

The Body-QoL questionnaire was answered by 92 patients (70%) who were at least 3 months postoperative. Postoperative results showed a median satisfaction score of 87 of 100, indicating that patients were generally very satisfied (>80 points) with the intervention. When evaluating each subcategory of the survey independently, it was found that patients were most satisfied with postoperative symptoms (median of 25 points of 25), followed by self-perception (median of 23 points of 25), sexual life (median of 22 points of 25), and finally, satisfaction with their body (median of 20 points of 25). Of the total study subjects, 11 patients fell within the “satisfied” range (60–80 points), mainly due to low scores in the satisfaction sections regarding their body and sexual life. Six individuals rated their satisfaction as “neutral,” indicating a neutral perspective on their self-esteem and a negative score in body satisfaction. Finally, only one patient reported being “dissatisfied,” primarily due to their self-perception,

**Table 6. Results from the Body-QoL Questionnaire**

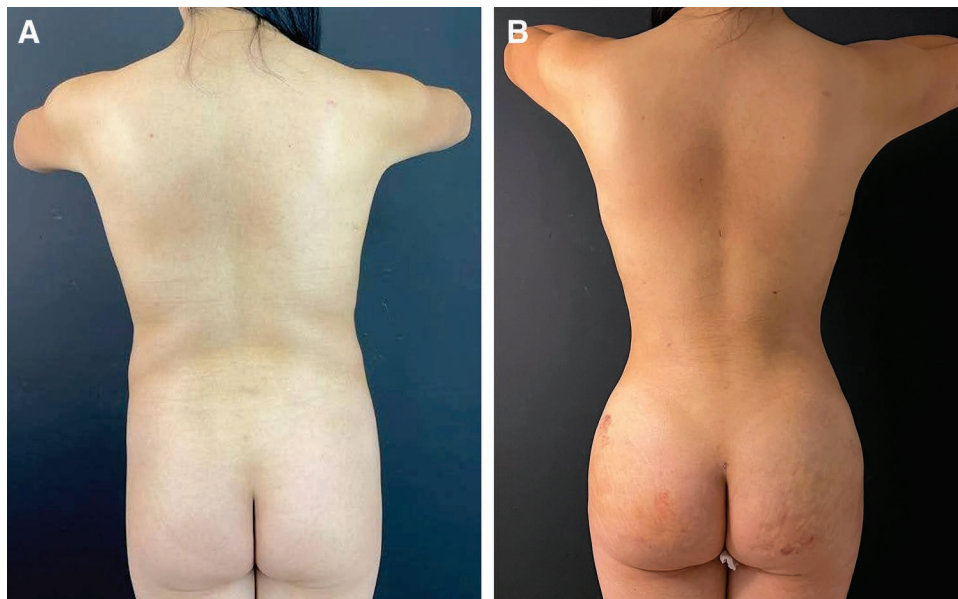
Subcategory	Median	IQR
Postoperative symptoms	25	4.5
Self-perception	23	4
Sexual life	22	8
Satisfaction with their body	20	6
Total	87	14

sexual life, and satisfaction with their body (Table 6). To note, this patient was one of those who had contour asymmetry, but unfortunately, she was not compliant with the use of the corset and garment.

## DISCUSSION

Bone structure high-definition remodeling (BS-HDR) incorporates new techniques that broaden the field of body contouring surgery. In this article, we presented our technique for rib remodeling and body contouring. Modification of bone structure is not new within the aesthetic surgery field. In fact, it was initially described and popularized by Verdugo<sup>8</sup> and Kudzaev and Kraiushkin,<sup>9</sup> among other authors.<sup>18–20</sup> We adopted the technique from Kudzaev due to its reproducibility and reliability compared with that from other procedures. However, most of these prior studies did not report statistical analysis or have an objective outcome evaluation.

We strongly believe that we have improved the technique from Kudzaev’s by using minimal and asymmetric incisions, by incorporating US to surgical planning and execution, and also by adding HDL to the technique. Such modifications ended up with an improved body silhouette with more natural and athletic results (Figs. 6 and 7). (See figure, Supplemental Digital Content 3, which shows

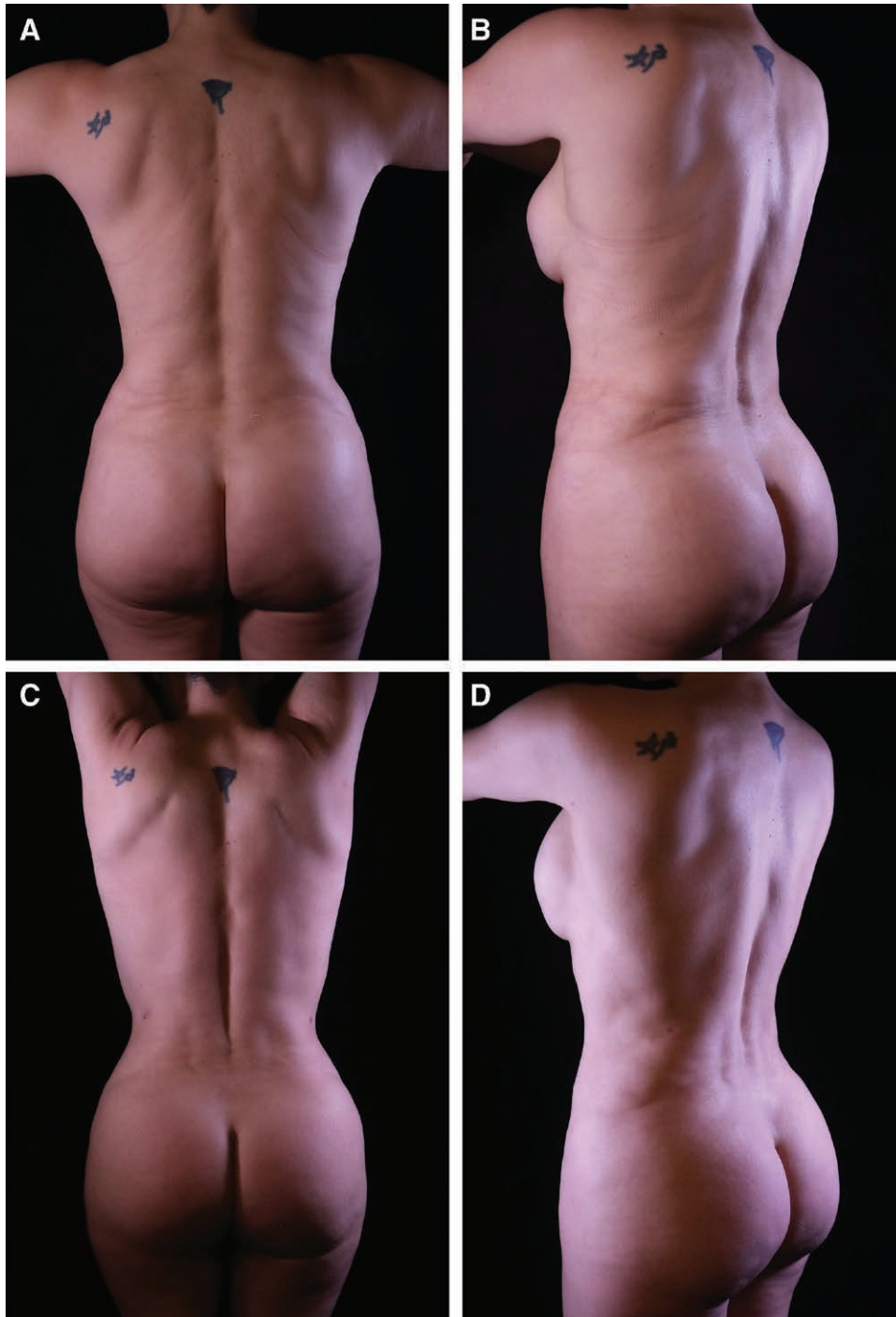


**Fig. 6.** Female patient: 37 years old. Preoperative BMI: 24.3 kg/m<sup>2</sup>. Technique: UUAIST (10th, 11th, and 12th ribs) + HDL. Lipoaspirate: 4100 mL. Prior liposuction: 0. A, Preoperative photograph shows a waist-to-hip ratio of 1:1.1 with fat deposits at the love handles and squared-shaped buttocks. B, The 2-week postoperative photograph shows a thin and soft-defined torso with a round buttock that accentuates a new 1:1.6 waist-to-hip ratio. Both the medial access and asymmetric incisions ensure the stealth nature of UUAIST technique.

a female patient: 29 years old. Preoperative BMI: 21.3 kg/m<sup>2</sup>, <http://links.lww.com/PRSGO/C998>.) (See figure, Supplemental Digital Content 4, which shows a female patient: 31 years old, <http://links.lww.com/PRSGO/C999>.) (See figure, Supplemental Digital Content 5, which shows a female patient: 40 years old, <http://links.lww.com/PRSGO/C1000>.) Our study involved different centers and surgeons trained under the same method. This supports the reliability, consistency, and safety of our technique. Moreover, we analyzed the outcomes through a validated scale for body contouring surgery (Body-QoL), which further supports UUAIST generalizability. Our findings demonstrate that UUAIST can be performed in less than 60 minutes, with a high satisfaction rate and minimal complications.<sup>21–23</sup> Besides, a 7-cm reduction was reported for rib remodeling alone compared with the 9-cm reported by HDL + rib remodeling. This not only means that rib remodeling can be added to HDL but also supports the great reduction of waist circumference by UUAIST. Although long-term effects of UUAIST might be a matter of concern, we have seen patients 8–9 months after surgery who have fully returned to their workout activities, daily routines, and jobs without any detrimental consequences.

On the other hand, our results indicate that candidates for UUAIST are usually those who have previously undergone liposculpture but lack adequate waistline definition. Typically, fit sportswomen who develop strong oblique muscles cannot get a good waist definition due to their lateral expansion of the ribcage. Comparatively, men usually develop wide dorsal muscles that enhance the V-shape; therefore, waist definition is not usually necessary. Nonetheless, thin or ectomorphic male-to-female

transgender individuals do seek UUAIST or other S-HDR procedures to improve the waistline definition. Mature osteomuscular structure of the rib cage develops at teen and young-adulthood age; therefore, sportswomen and men tend to have a greater thorax expansion compared with other populations.<sup>10,11</sup> Each rib is mechanically connected to the other, playing an essential role in the ribcage's loading capacity as a complete unit.<sup>11</sup> As a result, some would consider the rib resection procedure highly invasive because the last pair of ribs are in close relationship with internal organs, potentially leading to life-threatening complications such as hemothorax, pneumothorax, and/or unnoticed organ damage. Moreover, studies assessing the efficacy and safety of this intervention have a low level of evidence and lack statistical analysis to support it.<sup>18</sup> We believe rib resection procedures should have precise indications and embrace a very small population and also must be performed in the in-hospital setting. In effect, surgeons deciding whether to go for rib resection or not must ensure that postoperative outcomes cannot be achieved by UUAIST or any other rib remodeling techniques, especially because internal organ protection, ventilation and respiratory biomechanics can be all affected by the lack of support from the floating ribs.<sup>24</sup> In contrast, green-stick fractures can be safely performed over the last two or three floating ribs with minimal risk for complications, although it requires patient commitment and compliance to use the corset for 8–12 weeks. In addition, we consider preoperative CT scan evaluation mandatory for surgical planning but not for follow-up. Although remodeling of two ribs is usually enough, three ribs may be necessary for patients with long torsos and 1:1 preoperative waist-to-hip ratios



**Fig. 7.** Female patient: 47 years old. Preoperative BMI: 22.5 kg/m<sup>2</sup>. Technique: UUAIST (10th, 11th, and 12th ribs) + dynamic-definition liposculpture with moderate definition. Lipoaspirate: 6200 mL. Prior liposuction: 2. A-B, Preoperative photographs depict an overall fat accumulation over the torso with a poor waist definition. C-D, Three-month postoperative photographs show a slim and athletic torso with a better continuum of the torso-waist-hip contour. Rib remodeling (lateral access) gives the patient a new indentation of the torso, which blends with a new round contour of the hips.

(Table 1). The postoperative CT scan may expose patients to unnecessary radiation. Some authors have done it as per patient request, but it was not included in our protocol. Photographic and clinical assessment is almost always

enough; if in doubt, then US imaging is the choice for postoperative follow-up. Some cases with contour asymmetry were actually evaluated with US to make sure it was not a consequence of the surgery but rather an issue



with patient compliance with garment/corset wearing. Although not reported in our study, reintervention might be necessary when severe asymmetry occurs. In that sense, we also conducted a parallel study for foreign patients who requested UUAIST but were emphatic on being not 100% committed to wearing the corset for such a long period. Results from this study will be published in part II of our articles. Furthermore, we strongly encourage all surgeons to perform nerve blockage routinely. This is done to avoid postoperative prescription of opioids as much as possible because there has been a massive increase of opioid abuse among patients undergoing cosmetic procedures.<sup>25</sup>

**Limitations**

Due to law-enforced protection of patient identity in some countries, satisfaction score could not be directly linked to each corresponding patient. Therefore, we were not able to establish an actual association of the clinical variables with the satisfaction outcome, which would be very additive to our study. Also, the Body-QoL survey should have been carried out by patients during the pre-operative period to further support our data.

**CONCLUSIONS**

UUAIST is a safe and reliable technique for waistline definition, with a high satisfaction rate, almost-invisible scars, and minimal risk for complications. Incorporation of HDL to rib remodeling opens up a new horizon for bone structure modification surgery (S-HDR) that can be safely performed for patients who seek better aesthetic outcomes in body contouring.

**Alfredo E. Hoyos, MD**

Department of Plastic and Reconstructive Surgery  
Total Definer  
Av Carrera 15 No. 83-33, Suite 203  
Bogota, Colombia  
E-mail: [alhojos@gmail.com](mailto:alhojos@gmail.com)

**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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