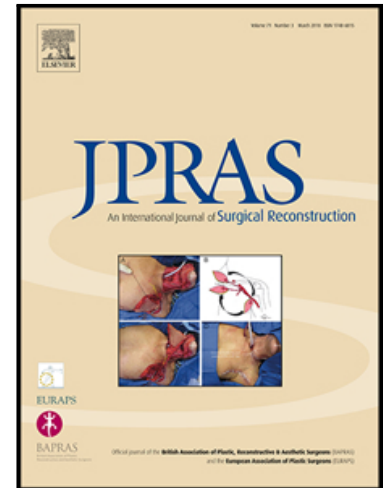


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“Improving symmetry of nipple areola complex (NAC) position in reduction mammoplasty using laser level projection”

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ABSTRACT

Background:

Symmetrical height of the nipple areola complex (NAC) is a key factor in the perception of breast symmetry. For preoperative markings, we mainly rely on conventional anthropometric measurements of distances in correlation to anatomical landmarks. In this study, we evaluated whether the use of a class-II laser projection water level would lead to better symmetry of nipple height in reduction mammoplasty procedures when used for preoperative planning.

Methods:

We analysed 100 patients undergoing reduction mammoplasty with a supero-medial pedicle and wise pattern skin resection. We compared the bilateral differences in nipple height from the last 50 reduction mammoplasty procedures before using the laser projection water level (group A; *no-laser*) to the first 50 reduction mammoplasties after implementation of this device (group B; *laser*). The follow-up period was 12 months.

Results:

48 patients were included in group A and 44 patients in group B. Patient demographics, mean resection weight and complications did not differ statistically significantly.

Nipple height differences were significantly lower in group B (*laser*), measuring 0.22 ± 0.20 cm (0–0.9; n = 44) compared to 0.61 ± 0.28 cm (0.2–1.2; n = 49) in group A (*no laser*; $p < 0.001$).

Conclusion:

Using laser level projection helped to improve nipple height symmetry in reduction mammoplasty. We consider a difference of more than one centimetre in nipple height to be unacceptable in aesthetic reduction mammoplasty. This simple tool facilitates preoperative markings and we find it to be safe, quickly installed, and very helpful in daily practice.

KEY WORDS:

Laser level projection, reduction mammoplasty, breast reduction, breast symmetry

Journal Pre-proof

BACKGROUND

Reduction mammoplasty is among the most frequent procedures in plastic surgery. In addition to volumetric symmetry and correct scar positioning, the symmetrical height of the nipple areola complex (NAC) is a key factor in the perception of breast symmetry.¹⁻³ Hence, precise preoperative markings are a key factor for optimising symmetry in breast reduction.^{4,5} Here, we mainly rely on conventional anthropometric measurements of distances in correlation with anatomical landmarks.^{3,5-7} For preoperative planning, the suprasternal notch (SSN)-to-nipple distance and the mid-clavicle (MC)-to-nipple distance is used to determine the correct nipple height.⁵⁻⁹ However, both distances lack precision.¹⁰ The width of the breast indicates the optimal nipple position in the centre of the breast.¹ Therefore, different breast widths affect the SSN-to-nipple distance, without providing a symmetrical height of the new nipple position. The MC-to-nipple distance accounts for different inaccuracies. Different breast widths may be levelled out to some degree, but the measurement may result in incorrect nipple positioning when there is an asymmetry of clavicle height or length. This finding is very common in patients undergoing breast reduction surgery. The prevalence of adolescent idiopathic scoliosis (AIS) with a Cobb angle $>10^\circ$ is between 0.5 and 5.2% in the normal population,¹¹ but the prevalence of asymmetries of the spine and shoulder girdle in patients suffering from macromastia is significantly higher.¹²

Patients mainly evaluate the correct nipple position based on their reflection in the mirror rather than by tape-measuring distances; thus, focusing on the identical height of the NAC of both their breasts.¹⁰

To ensure optimal symmetry in reduction mammoplasties, many plastic surgeons—our team included—bring their patients into the upright or beach chair position intraoperatively. Despite this, the correct positioning of the patients is not without errors. When tilting the operating room (OR) table and flexing the patient, one often observes remote slipping of the patient towards one side. This may go unnoticed to some degree.¹⁰ When examining the nipple position, a deviation of only a few degrees in the shoulder girdle may result in insufficient symmetry of nipple height.

Surprisingly, modern tools, as routinely used in other areas of precise planning, play a subsidiary role in plastic surgery practices.^{4,10,13-17} In 2020, we started using a commercially-available laser projection water level device in our practice.¹⁰ We evaluated whether the use of this tool has led to better symmetry of nipple height in reduction mammoplasty procedures when used for preoperative planning and intraoperative verification of correct NAC position.

MATERIALS AND METHODS

We used a commercially-available class-II laser projection water level (SmartCross Laserliner®; Laserliner Schweiz AG, Herisau, Switzerland) with a wavelength of 650 nm, accuracy ± 0.50 mm/m, operating distance 0–10 m, and auto-levelling $\pm 5^\circ$, which was mounted on a conventional tripod.

For preoperative markings, patients were provided with a pair of conventional laser-safety goggles (P1L15, NIR-filter wavelength 650–665 nm; Laservision GmbH Fürth, Germany).¹⁸

The laser was placed within 1 m of the patient for preoperative markings and within 3 m for intraoperative measurements.

We analysed 100 patients undergoing reduction mammoplasty with a supero-medial pedicle and wise pattern skin resection. All surgical procedures were performed in our department by four senior board-certified plastic surgeons. We compared the bilateral differences in nipple height of the last 50 reduction mammoplasty procedures before using the laser projection water level (group A; *no-laser*) to the first 50 reduction mammoplasties after implementation of this device (group B; *laser*).

The follow-up period in both groups was 12 months. We excluded all patients who were lost to follow-up, had another breast procedure in the meantime or underwent radiotherapy.

For preoperative markings in group B (*laser*), the laser projection water level was used to first mark a horizontal line 5 cm below the SSN in order to exclude asymmetries of clavicle height or length before further planning (Fig. 1). Then, the symmetrical height of NAC upper border markings was verified (Fig. 2).

Intraoperatively, all patients were brought into an upright beach chair position before skin closure to verify the symmetrical NAC position. In study group B (*laser*), the precise upright position of the patients was controlled by the correct alignment of two marker points in a horizontal line 5 cm below the SSN (Fig. 3). Then, the correct nipple height was verified (Fig. 4). The OR lights were dimmed for better visualisation of the projection lines.

Postoperative complications were classified as grade I (minor wound healing issues that needed no further intervention), grade II (wound healing disorders that required prolonged wound dressing, local wound debridements at regular post-op follow-up visits, local haematoma or seroma formation requiring release at regular post-op follow-up visits) or grade III (any complications requiring surgical intervention, including scar correction, surgical haematoma evacuation or secondary wound closure).

Standard follow-up measurements were obtained after 3 months, 6 months and 12 months using a standardized follow-up protocol, including standardised photography,¹⁹ measurements of deviation of nipple height, SSN-to-nipple

distances,^{6,8} MC-to-nipple distances, three-dimensional volumetric evaluations,^{20,21} scar quality and patients satisfaction.

All photographic images were analysed using Synedra View® Software (Synedra Information Technologies GmbH, Innsbruck, Austria). Pictures were calibrated using a standard gauge within the image plane. Differences in nipple height were calculated in a blinded fashion by determining the sagittal axis, placing the horizontal axis at a 90° angle through the right nipple, and measuring the distance from the horizontal axis at a 90° angle to the left nipple.

Statistical Analysis

The two cohorts (group A and group B) were compared using an independent-samples t-test for continuous variables and chi-square analyses for categorical variables to detect differences between the groups. A difference of $p < 0.05$ was considered statistically significant. All statistical analyses were performed using IBM SPSS® statistics software (Version 28.0; Chicago, IL, USA).

RESULTS

The time for correct installation of the laser level projection ranged from 20 s to 2 min (mean, 36.2 s; standard deviation [SD], 17.4 s), with a steep learning curve regarding the correct adjustment of the tripod.

Forty-eight patients were included in group A (*no laser*) and 44 patients in group B (*laser*). Patient demographics did not differ between the groups concerning age, body mass index or relevant co-morbidities (diabetes) (Table I). Mean resection weight was 504.48 ± 279.38 g (90–1480 g; n = 49) in group A (*no laser*) and 444.03 ± 254.39 g (120–1200 g; n = 44) in group B (*laser*). This difference was not statistically significant ($p = 0.247$).

Complications did not differ significantly between the groups (Table II).

Surgical intervention was necessary in two cases in group A (*no laser*). Both patients suffered from diabetes and presented wound healing complications requiring secondary wound closure in the T zone of the inframammary fold. One haematoma evacuation was necessary in group B (*laser*).

The follow-up period in both groups was 12 (11–19) months. Nipple height differences between the two operated sides were 0.61 ± 0.28 cm (0.2–1.2 cm; n = 49) in group A (*no laser*) and 0.22 ± 0.20 cm (0–0.9 cm; n = 44) in group B (*laser*) at the 12 (11–19)-month follow-up. These differences were statistically significant ($p < 0.001$) (Table 2).

DISCUSSION

We must accept that there is no perfect symmetry in the human body and that differences in NAC height in the scope of millimetres are both acceptable and subject to measuring tolerances. Therefore, although statistical significance was obtained, these results must be analysed carefully.

Nevertheless, we can say that we did not see outliers in nipple height differences when using laser level projection (group B) when compared to controls (group A; Fig. 5a, b, Fig. 6a, b). Thus, we conclude that using laser level projection seems to prevent mistakes either in preoperative planning or in intraoperative verification of correct NAC position.

The outliers in the control group clearly demonstrate the need to optimize markings or implement an objective intraoperative control. We are happy that we could demonstrate that the use of laser level projection did improve nipple height symmetry. Yet, we cannot state whether patients' satisfaction did improve significantly, since we did not collect patient reported outcome measures via validated score sheets. In this study, we merely tried to analyse the effect of our small but significant modification of preoperative markings on nipple height symmetry. Patient satisfaction after reduction mammoplasty is generally very high,²²⁻²⁵ we do not dare to believe that our modification would make any significant difference. However, as plastic surgeons, we are committed to perfectionism and must perpetually try to improve even the smallest step towards the optimal result.

We agree that NAC height is only one of several aspects that play a role in the perception of breast symmetry; breast shape and volumetric symmetry may be more important. Yet, mistakes in NAC-placement are easy to avoid with our technique. Generally, we find it relevant to refine and objectify every small step to improve the overall outcome. Especially in a teaching hospital, it is important to standardise and facilitate preoperative markings to achieve reproducible and aesthetically sufficient results throughout the entire team.

One can speculate whether the laser level projection-assisted intraoperative verification of correct nipple position alone led to the improved outcome in group B, or whether the laser level projection-assisted preoperative planning itself made for better results.

Patient satisfaction certainly is the most important indicator when evaluating a new technique or the modification of an existing one. However, patient satisfaction after reduction mammoplasty is generally very high. We do not dare to believe, that improved NAC symmetry will make a difference in PROM, but we do believe that laser level projection is an easy to use and reliable technique to prevent mistakes that lead to inferior results.

We are aware that the breast continues to undergo changes e.g. bottoming out or lower pole expansion after 12 months post-surgery. Regardless, a follow-up period of 12 months seems to be acceptable for determining the symmetry of the

nipple position. Although differences of a few millimetres are subject to measurement errors, incorrect patient placement in front of the photographic background, or slight movements before or while taking the picture, we consider a difference of more than one centimetre in nipple height to be unacceptable in aesthetic reduction mammoplasty. To expunge mistakes that lead to such inferior results, the laser projection water level seems to be beneficial.

Surprisingly, this technique does not seem to be in use by plastic surgeons, so far. We found only one article of a work group from Boston, using a laser projection grid to improve symmetry in two cases of breast reduction.²⁶ To assess symmetry, a fixed grid was projected intraoperatively. However, they did not use a water level, but a class 3B laser projection device.

We see the clear benefit of using a class 2 laser level device. It is affordable (approximate cost: 120–150 USD, including the tripod), safe, quickly to install and it both objectifies and simplifies the preoperative markings. We do not want to work without this simple and helpful tool in our clinic anymore.

However, one must be cautious when using this tool on an unevenly contoured body surface, e.g., when making preoperative markings on augmented breasts, especially when the implant position is different on each side. Although the irregular implant position as an aspect of asymmetry will be corrected in the operation, the skin envelope above the new nipple position remains unaltered. Hence, the new nipple position will be projected at a different distance from the upper breast border.¹⁰ In such instances, we suggest relying on the conventional

measurement of distances at skin level to determine the correct neo-areola position.

CONCLUSIONS

We do not want to work without this simple tool in our clinic anymore. It facilitates and objectively measures the preoperative markings and we find it to be safe, quickly installed and very helpful in daily practice.

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Conflicts of interest: None declared

Ethical approval: Not required

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	Group A Mean \pm Std (Min, Max)	Group B Mean \pm Std (Min, Max)	p-Value	Test
Age at surgery	42.10 \pm 13.98 (18; 69), n = 49	42.27 \pm 16.78 (17; 72), n = 44	0.988	MWU
Gender	49 Female	44 Female	-	Fisher
Side (Uni/Bilateral)	49 Bilateral	44 Bilateral	-	Fisher
Body Mass Index	26.94 \pm 3.88 (20.8; 39.2), n = 49	25.13 \pm 3.44 (20.5; 32.7), n = 44	0.224	MWU
Diabetes	2/49	0/44	-	-
Primary reduction mammoplasty	49	44	-	-

Table I: Patients Demographics

	Group A	Group B	p value
Resection Weight both Sides	504.48 ± 279.38 (90; 1480) n = 49	444.03 ± 254.39 (120; 1200) n = 44	0.247
Resection Weight Right Side	506.63 ± 293.03 (90; 1480) n = 49	443.93 ± 262.65 (120; 1200) n = 44	0.239
Resection Weight Left Side	502.34 ± 268.06 (120; 1290) n = 49	444.13 ± 248.89 (120; 1200) n = 44	0.256
Nipple Height Difference 12 months postoperatively	0.61 ± 0.28 (0.2; 1.2) n = 49	0.22 ± 0.20 (0; 0.9) n = 10	<0.001
Complications (Grade I-III)	Grade I : 4 Grade II : 2 Grade III: 2	Grade I : 4 Grade II : 3 Grade III: 1	0.816

Table II: Intra- and postoperative results; values are given as mean ± SD [95% Confidence Interval] or (minimum; maximum).

FIGURE LEGENDS

Fig. 1

Laser level-assisted preoperative marking in Patient 1: first, a horizontal line 5 cm below the SSN was marked in order to exclude asymmetries of clavicle height or length before further planning (a recognisable tattoo below the left clavicle has been obscured).

Fig. 2

Laser level-assisted preoperative marking in Patient 1: Planning of symmetrical height of new NAC upper border.

Fig. 3

Intraoperative laser level projection in Patient 1: First, the precise upright beach chair position of the patient was verified by correct alignment of two marker points in a horizontal line 5 cm below the SSN.

Fig. 4

Intraoperative laser level projection in Patient 1: The symmetrical height of the nipple position was verified.

Fig. 5

Mean Nipple Height Difference 12 months postoperatively. Differences in nipple height were significantly lower ($p < 0.001$) in group B using laser level projection (mean 0.22, range 0-0.9, SD 0.20) compared to group A (mean 0.61, range 0.2-1.2, SD 0.28)

Fig. 6a + b

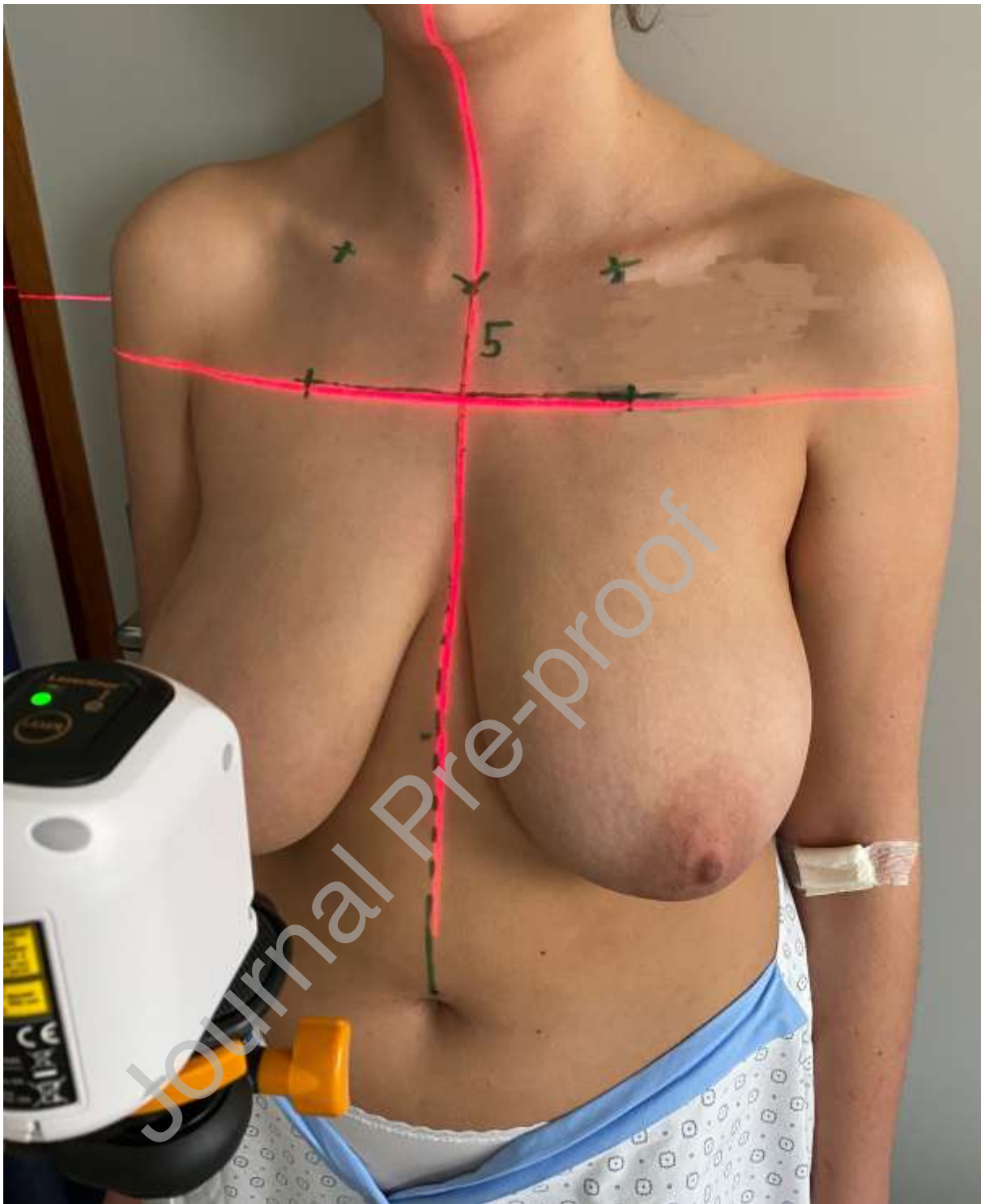
Preoperative (5a) and postoperative (5b; 12 months postoperatively) photographs of Patient 1 (group B; *laser*): Resection weight was 470 g (right) and 360 g (left). The postoperative difference in nipple height was 2.3 mm. Note the difference in clavicle height preoperatively, which could possibly have led to asymmetric marking of the new NAC position. The difference in clavicle height is still present 12 months postoperatively, despite the symmetrising reduction mammoplasty, indicating a fixed rather than compensatory asymmetry.

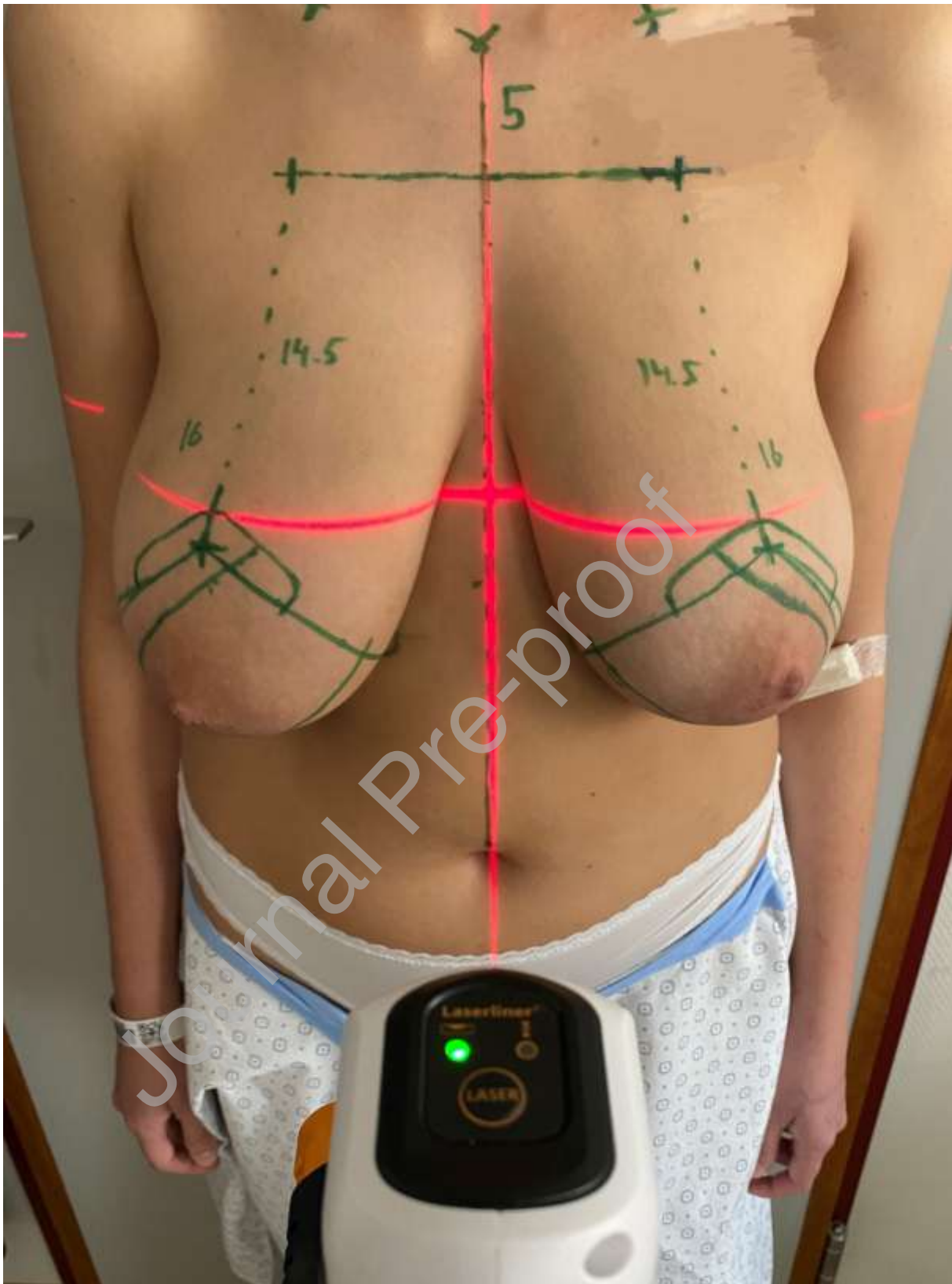
Fig. 7a + b

Preoperative (6a) and postoperative (6b; 12 months postoperatively)

photographs of Patient 2 (group A; *no-laser*): Resection weight was 490 g (right) and 550 g (left). The postoperative difference in nipple height was 10.7 mm. This outlier in nipple height symmetry is considered unacceptable.

Note the difference in clavicle height preoperatively, which could have led to asymmetric marking of the new NAC position. The difference in clavicle height is still present 12 months postoperatively, despite the symmetrising reduction mammoplasty, indicating a fixed rather than compensatory asymmetry.









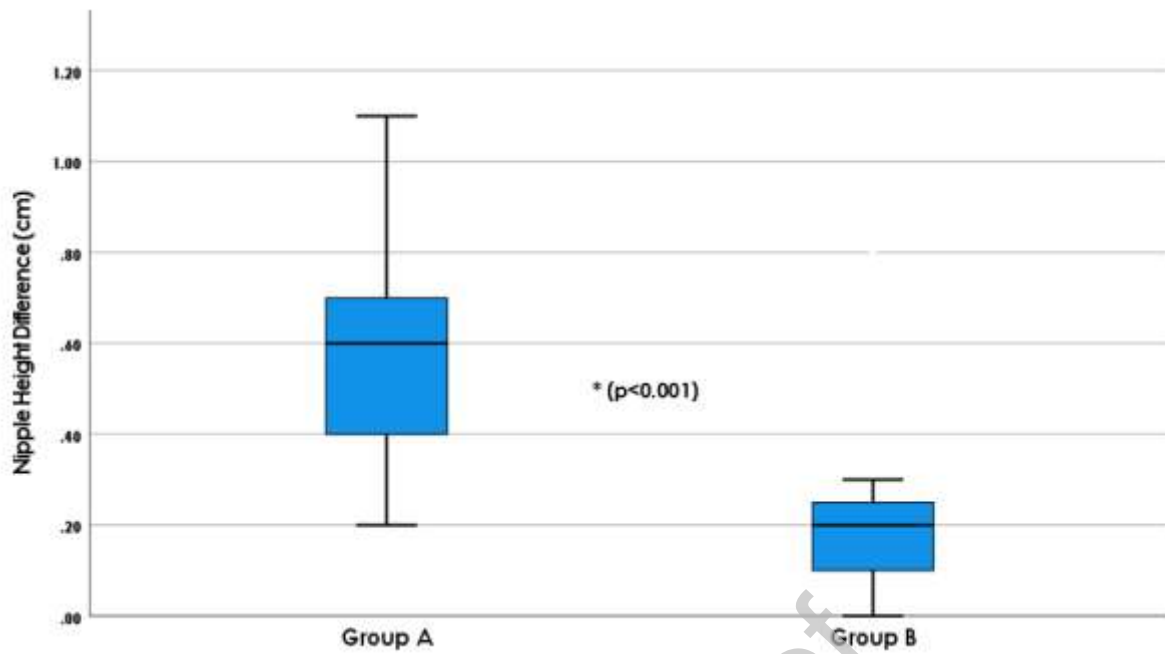


Fig. 5

Mean Nipple Height Difference 12 months postoperatively. Differences in nipple height were significantly lower ($p < 0.001$) in group B using laser level projection (mean 0.22, range 0-0.9, SD 0.20) compared to group A (mean 0.61, range 0.2-1.2, SD 0.28)

