



Evaluation of nipple-areola complex sensitivity after the latero-central glandular pedicle technique in breast reduction

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Summary Introduction. Previous anatomical and clinical studies have shown that nipple-areola sensitivity decreased significantly after conventional superior and inferior pedicle technique for 3-6 months postoperatively. We found it necessary to modify our techniques in breast reduction to achieve a better outcome regarding breast sensation. Since 1999, we have been using a new technique of breast reduction with a latero-central glandular pedicle. The pedicle for the nipple-areola is based on a horizontal septum and it is designed to incorporate the anterior ramus of the lateral branch of the fourth intercostal nerve and perforator vessels. Using this technique, a prospective study was conducted in order to quantitatively assess the nipple-areola sensitivity.

Material and methods. The sensitivity of the nipple-areola complex (NAC) was evaluated in 20 consecutive patients undergoing breast reduction with the septum-based lateral pedicle technique. The sensitivity was assessed preoperatively, 2 weeks and 3 months postoperatively by the same examiner. The nipple and four cardinal points of the areola were tested. Pressure thresholds were measured with Semmes-Weinstein monofilaments, temperature sensitivity with hot (40 °C) and cold (4 °C) metal probes and vibratory thresholds with the Biothesiometer. Average sensation of the areola was calculated by means of the four areas tested.

Results. Average values of different patterns of sensitivity decreased significantly on the tested areola 2 weeks postoperatively. Three months postoperatively, pressure and vibration values were statistically comparable in averages to preoperative values (nipple: 46.2 ± 3.8 versus 34.6 ± 2.2 g/mm² and 6.4 ± 1.2 versus 3.7 ± 1 μ ; areola: 57.4 ± 5.7 versus 49 ± 6.8 g/mm² and 6.7 ± 1.2 versus 3.1 ± 0.6 μ). Concerning the ability to recognise temperature, 27.5 and 20% of patients could not distinguish between cold and hot 3 months after surgery, on the nipple and the areola, respectively. Numbness was found only on two NAC despite the significant decrease of sensitivity after 2 weeks. This may be attributed to postoperative oedema or neuropraxia.

Conclusion. Our results showed that using the latero-central glandular pedicle technique preserves the sensitivity of the NAC.

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The preservation of breast sensation has not always been the main goal in breast reduction techniques. It has mostly been secondary to ensuring adequate blood supply to the nipple-areola complex (NAC), a good aesthetic shape and a long lasting outcome.^{1,2} Many techniques of reduction mammoplasty have come up with adequate aesthetic results and many methods have been developed to measure skin sensitivity. Evaluation of pressure, vibration sensitivity and the ability of temperature discrimination are useful tools to quantitatively measure breast sensation after reduction mammoplasty.³⁻¹² Erogenous sensation has a subjective value and it is very difficult to assess and evaluate.

Anatomy of breast nerve supply has been widely described. However, there is a lot of controversy about the course of these nerves in breast tissue and the implication of these findings in technical developments of reduction mammoplasty.¹³⁻¹⁷

Since 1999 we have been using a new technique of breast reduction with a latero-central glandular pedicle.¹⁸ The pedicle for the nipple-areola is designed to incorporate the lateral branch of the fourth intercostal nerve and perforator vessels. Using this technique, a prospective study was conducted in order to assess the nipple-areola sensitivity quantitatively.

Material and methods

The sensitivity of NAC was evaluated in 20 consecutive patients undergoing breast reduction using a latero-central glandular pedicle technique. The patients were operated on by the same surgeon (MH) and the sensitivity was assessed by the same examiner (KVDS). The patients were evaluated preoperatively and 2 weeks and 3 months postoperatively. Five points were tested on each (NAC). These points included the nipple and four cardinal points on the areola at 12, 3, 6, and 9 o'clock. Pressure thresholds were measured with a set of 20 Semmes-Weinstein monofilaments (Smith and Nephew Rolyan, Menomane Falls, WI, USA). The test was performed in a standard way as it was recommended by the manufacturer's note. The area was considered insensate if pressure was not sensed when the (6.65) monofilament was applied. The values were converted to a measured stress (g/mm^2).¹⁹

A Biothesiometer (Biomedical Instrument Co, Newbery, OH, USA) was used to measure vibratory thresholds in the same reported way.²⁰ Values were expressed in micrometers. The area was considered insensate if the threshold was more than 25.5μ .

The mean values of pressure and vibration thresholds of the four tested areas on the areola were calculated to obtain one mean value for each areola.

Temperature sensitivity was measured with hot 40°C and cold 4°C metal probes (Smith and Nephew Rolyan) that were applied to the tested areas. The test was considered 'negative' if the patient could not recognise the temperature.

Statistical analysis was done in an intention-to-treat way. Each breast was considered independently. A one-factor (time) analysis of variance for repeated measure was performed for pressure and vibration thresholds. When the *F* ratio reached the critical tabulated value ($P < 0.05$) pairwise comparisons were made using modified *t*-test. The MacNemar X2 was used to compare temperature results. Comparisons of percentage between groups were made using a z-test for proportions. $P < 0.05$ was considered significant.

Results

Twenty consecutive patients were entered into this study with a complete follow-up. We treated 40 breasts as independent measurements, because the right and left breasts were commonly asymmetric. Mean age of the patients was 40 years (range 18-66 years). The mean sternum-to-nipple distance was 31 cm (22-38 cm). Mean amount of gland tissue resected was 618 g (range 55-1585 g). Wound healing around the areola was uneventful in all patients. But a retro-areola haematoma occurred in one patient necessitating surgical drainage.

Two weeks postoperatively, insensate areas for pressure were found on two (NACs). But none of them was insensate at 3 months. One of these two (NACs) was also insensate to vibration and it sustained a borderline value (25.5μ). This patient had the retro-areola haematoma. Another different NAC was insensate to vibration.

On the areola areas tested, mean pressure and vibration thresholds decreased significantly at 2 weeks as compared to preoperative values. At 3 months postoperatively, pressure and vibration thresholds were quite similar to preoperative values of both areola and nipple (Table 1).

The ability to recognise temperature was found on 33% of nipples and 37% of areolas and 72.5% of nipples and 80% of areolas at 2 weeks and 3 months, respectively, after surgery (Table 1).

Table 1 The sensitivity of nipple-areola complex preoperatively, 2-week and 3-month postoperatively

Sensation test	Site	Preoperative value	2-week value	<i>P</i>	3-month value	<i>P</i>
Pressure (g/mm ²)	Nipple	34.6 ± 2.2	134.2 ± 23*	0.001	46.2 ± 3.8	NS
	Areola	49.2 ± 6.8	152.3 ± 24.5*	0.001	57.4 ± 5.7	NS
Vibration (μ)	Nipple	3.7 ± 1	10.3 ± 1.5*	0.003	6.4 ± 1.2	NS
	Areola	3.1 ± 0.6	9.7 ± 1.5*	0.001	6.7 ± 1.2	NS
Hot and cold discrimination %	Nipple	95%	30%*	<0.001	72.5%	0.006
	Areola	95%	37%*	<0.001	80%	0.04

Values are mean ± SEM or percent. **p* < 0.05. NS, nonsignificant.

Discussion

Breast reduction patients are generally considered to have a high rate of satisfaction because they are no longer burdened with symptoms of hypertrophic breasts.²¹⁻²³ Moreover, it seems that reduction mammoplasty provides long-term improvement in health status and quality of life.²² Therefore, the majority of these patients are usually satisfied with the outcome in terms of breast sensation because of the global benefit. However, in prospective and well-documented studies, breast sensation has been negatively affected by surgery.^{5-7,9,11,12} Different outcome of NAC sensitivity after reduction mammoplasty has been reported in literature.¹⁰ The results depend on many factors such as age, breast ptosis, amount of gland removed and surgical technique. Nowadays, patients' requirements and expectations become higher and patients undergoing plastic surgery are more demanding than before. In our practice, we have encountered more patients who asked for a specific cup size, for a particular breast form and to preserve nipple-areola sensation and the ability to nurse.

We had mainly been using a superior pedicle technique in breast reduction for years with acceptable aesthetic results. However, breast sensation decreased significantly after the vertical mammoplasty technique with superior pedicle.⁹⁻¹¹ One might attribute this significant loss of NAC sensitivity to the thinning of the pedicle under the areola. This overzealous thinning is necessary to avoid pedicle kinking and it is a major point of Lejour's technique.¹ Another technique in reduction mammoplasty such as the inferior pedicle claimed to insure better nipple sensation.² However, previous studies showed clearly that standard techniques could not preserve an adequate NAC sensitivity in the immediate postoperative period.^{9,12} In a previously performed prospective study, we compared two techniques, Lejour's and Robbins' at 3 and 6 months postoperatively. NAC sensitivity decreased significantly in both groups.⁹ Although, it

has been shown that patients with an inferior pedicle had better NAC sensation compared to those with a superior pedicle. The differences became insignificant at 6 months postoperatively. To explain these results, a histological and anatomical study was performed.²⁴ The nerves were located and quantified in the inferior pedicle and the superior pedicle after breast reduction performed on cadavers. It has been shown that there is more chance to incorporate nerves in an inferior pedicle than in a superior pedicle. However, pedicles without including nerves were found in both techniques. We learn from the two above-described studies that classical techniques in breast reduction cannot completely preserve NAC sensitivity.^{9,24} Breast sensation after breast reduction seems to depend on nerve regeneration more than on nerve preservation.

Based on these findings, we advocated new techniques or modifications to the existing ones.²⁴ Detailed anatomical studies showed that the anterior and lateral cutaneous branches of the third, fourth and fifth intercostal nerves are the main nerve supply to the NAC.¹⁴⁻¹⁷ The idea is to include a maximum of those branches in the pedicle. Precise knowledge of the course of these nerves is essential for designing a breast reduction technique. The course of these nerves has always been controversial.¹³⁻¹⁷ Wuringer et al.¹⁶ described a horizontal septum that contains the blood and nerve supply to the NAC. These authors dissected 12 breasts, and in each case, a deep branch of the lateral cutaneous branch of an intercostal nerve was located within the septum. It originated from the fourth mostly or from the fifth intercostals nerve. They also found a dual nerve supply from the anterior and lateral cutaneous branches of the second to fourth intercostal nerves with a subcutaneous course along the gland toward the NAC. These findings were in accordance with a more recent anatomical study conducted by Schlenz et al.¹⁷ They found that the lateral cutaneous branch of the fourth intercostals nerve supplied the nipple in 93% of the dissected breasts in a similar

Table 2 A comparison of pressure threshold values (mean \pm SEM) between different techniques

	Site	Superior pedicle	Inferior pedicle	Septum-based lateral pedicle
Pre-operative values	Nipple	26 \pm 4	23 \pm 2	34.6 \pm 2.2
	Areola	38 \pm 4	41 \pm 3	49.2 \pm 6.8
3-month post-operatively	Nipple	81 \pm 29*	75 \pm 19*	46.2 \pm 3.8
	Areola	97 \pm 26*	77 \pm 16*	57.4 \pm 5.7

* $p < 0.05$ is statistically significant difference between the preoperative and 3-month postoperative values in each group.

'deep' course to the ones described by Wuringer et al.¹⁶ and by Craig and Sykes.¹³ The course of the anterior cutaneous branches of the third, fourth and fifth took a superficial course in the subcutaneous tissue.¹⁷

Since 1999, we have been using a new technique in breast reduction to achieve better outcome in terms of nipple-areola sensation.¹⁸ The NAC is based on a lateral glandular pedicle designed to include the horizontal septum, which was also described by Wuringer et al.¹⁶ A prospective study of NAC sensitivity was performed on 20 consecutive patients, who were operated by the same surgeon. This technique is supposed to preserve the deep branch of the fourth intercostal nerve. Logically one can expect to preserve an adequate sensation to the NAC in the immediate postoperative period. However, a complete preservation of the sensitivity is impossible because the surgical incision around the medial side of the areola will damage the anterior branches of the intercostal nerves. This was confirmed by our results. Sensitivity of the NAC decreased 2 weeks postoperatively. However, the decrease was not significant. In two breasts (5%) there were insensate areas. This can be explained either by the postoperative oedema or haematoma in the breast or more probably by the damaging of the nerves due to a variation of their course. Anatomical variation of the course of the deep branch was reported in 7% of cases in which the branch had a superficial course resulting in the possibility of damage during surgery.¹⁷ Similar results were found by Temple and Hurst.¹⁰ In their study, insensate areas were found on 4 (5%) out of 80 tested areolas at 2 weeks postoperatively. However, these authors used Semmes-Weinstein monofilaments only to evaluate the sensitivity. They even reported an improvement in the sensitivity of the NAC at 2 weeks after breast reduction with a modified inferior pedicle. It is hard to find the explanation for their unique results in particular, if one looks at the findings of the above-described anatomical studies.¹⁴⁻¹⁷ Nevertheless, they attributed the better values of sensitivity to the nerve relief from the chronique traction due the heaviness of the breast.¹⁰ However, the authors did

not evaluate any other kind of sensitivity such as vibration and temperature discrimination. Multiple tests have to be considered to evaluate breast sensation after surgery. We used the most accepted methods for testing the sensitivity. However, pressure and vibration thresholds, tested at 2 weeks and 3 months postoperatively, were statistically comparable to preoperative values. However, ability of discrimination between hot and cold was lost in one-third and one-fifth of our patients at 2 weeks and 3 months, respectively. Small myelinated fibres, which may be more vulnerable to injury during surgery, mediate temperature sensation or these fibres may be more representative within the anterior cutaneous branch of the intercostals nerves. This is very difficult to confirm without evoked potential studies to evaluate the difference in impulse stimulation with temperature between the lateral and medial side of the areola. When we compare our own results of the present study and our previous study,⁹ we can find better average pressure threshold of the areola after our new technique than those after the ones used by Lejour's and Robbins (Table 2). When we compared NAC sensitivity between patients after Lejour's vertical scar technique with a superior pedicle¹¹ and our patients after the septum-based lateral pedicle, one can clearly find a significant difference in results for all sensory patterns, pressure, vibration and temperature, at 3 months postoperatively.

Conclusion

Although satisfactory aesthetic results can be achieved with superior pedicle reduction mammoplasty, we found it necessary to modify our techniques in breast reduction to achieve a better outcome regarding breast sensation. Moreover, designing the pedicle laterally prevents pedicle kinking and consequently reduces venous congestion, which are often observed with superior pedicle mammoplasty. Based on a good vascularised and constant anatomical septum, the latero-central pedicle is safe even in major breast

hypertrophy. The latero-central glandular pedicle technique shows clear advantages over the conventional techniques of breast reduction in terms of breast sensation and ease of pedicle shaping and modelling.

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