

NIPPLE SENSITIVITY FOLLOWING REDUCTION MAMMAPLASTY

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DESCRIPTIONS of the nerve supply of the nipple and areola receive little attention in most general textbooks of anatomy. *Gray's Anatomy* (1966) describes the nerve supply to the breast as being via anterior and lateral cutaneous branches of the fourth, fifth and sixth thoracic nerves and Last (1966) makes no specific reference to the nerve supply of the nipple. Probably the most detailed descriptions are those of the last century. Astley Cooper (1840) stated that the principal nerve supply of the nipple was through anterior cutaneous branches of the third, fourth and fifth intercostal nerves and through filaments of the lateral cutaneous branches of the fourth and fifth intercostal nerves. Each of these branches accompanied mammary arteries and communicated with twigs from adjacent nerves giving off two branches, one passing through the breast to the nipple and the other passing superficial to the breast to the areola. The description of Eckhard (1858) is similar. The branches passing superficial to the breast were called "skin-nerves" and were stated to be distributed mainly to the skin with some terminal twigs reaching the nipple. The deep branches, following the anterior surface of the pectoralis major muscle, were described as entering the gland posteriorly close to its edge. After first passing some distance within the gland substance, they were found to ramify as they reached the milk ducts, following them to the apex of the nipple.

Nipple sensitivity following reduction mammoplasty is considered by relatively few authors in the literature. McIndoe (1938), reporting 80 cases treated by the Biesenberger technique, noted reduction or complete absence of sensitivity in 50 per cent. of cases, often occurring unilaterally. Ragnell (1946, 1957), reporting 300 cases treated by his personal technique of upper and lower midline sector resection of the gland after raising the skin envelope, found normal nipple sensitivity in 73 to 83 per cent. five months post-operatively. Grenabo (1957) reported testing sensitivity in 80 free-grafted nipples and found only one in which sensitivity was totally lost. Tamerin (1963) stated that, after successful Lexer-Kraske technique reduction, some patients had noticed increased erotic sensitivity of the nipple and in some instances development of such sensation where none had previously existed. Skoog (1963) described a series of 19 cases treated by his single dermal pedicle technique three months post-operatively, stating a sensation to be normal in eight, depressed in eight, and poor in three; while a series of 20 cases treated by the double dermal pedicle technique was reported as normal in 16, decreased in three, and poor in one. Strömbeck (1964) described a review of 159 patients nine months following reduction mammoplasty by his own technique. He found that nipple sensitivity was normal in 55 per cent., reduced in 29 per cent., and poor in 16 per cent. Gupta (1965) considered that nipple sensitivity was very difficult to assess objectively, and that altered sensation could pass unnoticed by some patients. Only two patients in a series of 191 treated reported alteration or complete loss of nipple sensation, and in one of these there had been improvement to a certain extent with time. Both of these cases had been done by the Biesenberger technique.

A study of the anatomical pathways of the nerve supply of the nipple and areola, based on the findings of 10 macroscopic dissections in cadavers, has been made (P.A.S.). The findings would appear to be at variance with the classical descriptions of the nerve

supply. Parallel with this study, a retrospective clinical review of all cases of reduction mammoplasty undertaken during an eight-year period at the Regional Plastic Surgery Unit by a number of surgeons using a variety of techniques, with particular reference to alterations in nipple sensitivity following operation, has been undertaken (R.D.P.C.). Particular emphasis has been applied to comparison of the subjective and objective assessment of nipple sensitivity, as most previous reviews appear to be based mainly on subjective criteria.

Anatomical Technique and Findings.—Macroscopic dissections were performed on the breasts of three male and seven female cadavers between the ages of 22 and 76.

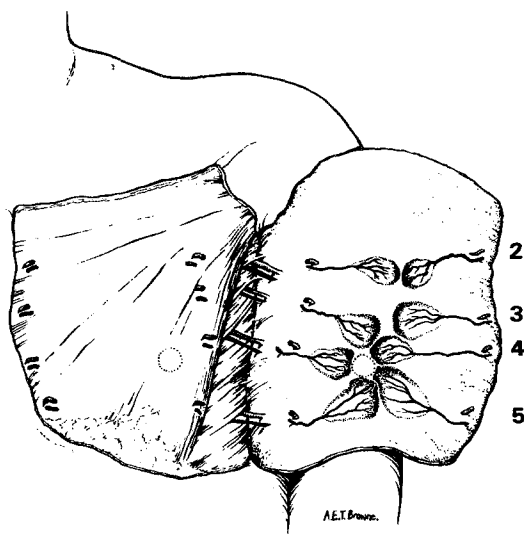


FIG. 1

A drawing to show a typical dissection. A flap of skin and superficial fascia has been reflected from the midline anteriorly, to the posterior axillary line. The anterior cutaneous nerves and both anterior and posterior branches of the lateral cutaneous nerves have been identified as they pierce the deep fascia and their branches have been traced towards the nipple from the deep surface of the flap. The position of the nipple is marked by a dotted circle.

None was known to have had any breast disease nor was any evidence of such disease found during dissection.

In each case, the anterior and lateral cutaneous nerves were identified as they emerged through the deep fascia. By careful dissection, these nerves were traced through the subcutaneous tissues. The relatively large nerves passing through the subcutaneous tissues were easily traced, but the smaller terminal branches in the fibrous and glandular tissue of the breast were traced only with difficulty. Nevertheless, it was possible to demonstrate terminal filaments of the anterior cutaneous nerves passing to within 3 cm. of the terminal twigs of the lateral cutaneous nerves (Fig. 1).

The nipple and areola were found to be regularly supplied by branches from the anterior cutaneous nerves of the third, fourth and fifth intercostal nerves and by branches from the lateral cutaneous nerves of the fourth and fifth intercostal nerves. The lateral branch of the third intercostal nerve supplied this area in 6 of the 20 dissections. The

branches of the third intercostal nerve were distributed mainly above and those of the fifth mainly below the nipple. Terminal twigs of the anterior and lateral cutaneous branches of the fourth nerve were all directed towards the nipple.

Anterior cutaneous branches pierce the deep fascia at a relatively constant position within a centimetre of the lateral margin of the sternum and are accompanied by a penetrating branch of the internal mammary artery. They then divide into a larger lateral branch (destined for the breast) and a smaller medial branch. The smaller accessory anterior cutaneous nerve appears in the lower half of the intercostal space, but cannot be traced for more than 2 cm. and never reached the areola or nipple.

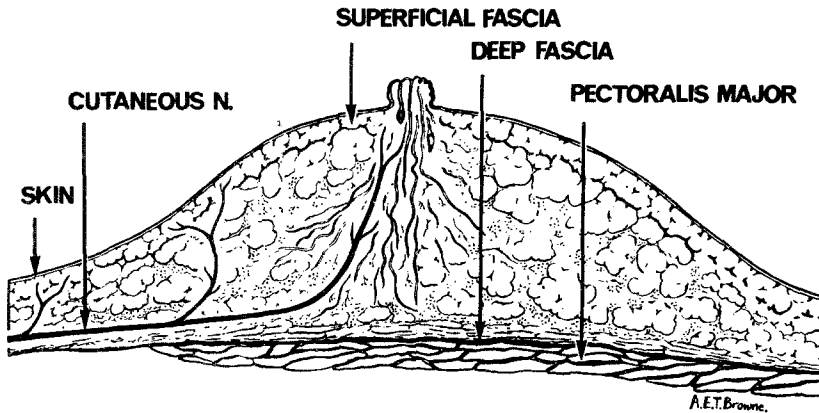


FIG. 2

A diagram illustrating the typical course and distribution of the nerves innervating the nipple. (For full description see text.)

The lateral cutaneous nerve is larger than its anterior counterpart and divides into anterior and posterior branches beneath the deep fascia. These penetrate the deep fascia separately but within 3 cm. of each other. The anterior branch appears just anterior to the mid-axillary line lateral to the edge of the pectoralis major muscle, and is smaller than the posterior branch. Both branches lie close to, but not in contact with the lateral branches of the intercostal arteries. The lateral branches of the anterior cutaneous nerves and the anterior branches of the lateral cutaneous nerves pass to the breast and the nipple.

No branch either of the anterior or lateral series of intercostal nerves was found passing superficial to the breast tissue to reach the nipple. The nerve tended to stay close to the layer of deep fascia on the anterior surface of pectoralis major muscle passing at first through the deepest part of the subcutaneous tissue and then into the base of the breast. It only inclined superficially towards the nipple as it approached its termination.

Small proximal branches pass through the subcutaneous tissues to reach the skin over the breast (*never the nipple*), and other more distal branches pass through the gland and subcutaneous tissues to reach the peri-areolar skin. Terminal branches pass to the nipple closely related to the fibrous septa (ligaments of Cooper) and follow the line of the ducts towards the nipple. Small branches also pass to the breast tissue itself (Fig. 2).

CLINICAL MATERIAL

In the eight-year period studied a total of 70 reduction mammoplasties were undertaken. Of these cases, 50 patients (97 nipples) participated in the review. No case operated on less than nine months previously was included.

Presenting Symptoms and Type of Operation.—These factors are detailed in Tables I and II.

Age.—Over 80 per cent. of the cases came within the age groups 15 to 25 and 40 to 60.

TABLE I
Presenting Condition

Gross hypertrophy	34
Adolescent gynæcomastia	9
Asymmetry	5
Ptosis	2
Intertrigo (with gross hypertrophy)	1

TABLE II
Type of Operation Undertaken

Penn I	17
Free transplant	13
Penn II	5
Oblique	4
Biesenberger	3
Strömbeck	3
Skoog :	
Unilateral pedicle	3
Double pedicle	2

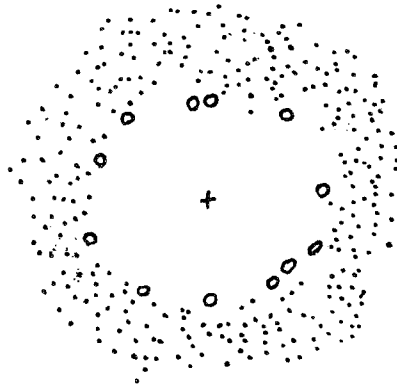


FIG. 3
Diagram of sweat test of nipple region
(centre of nipple marked with X).

Lactation.—The lactational histories are perhaps of interest in view of the concept that most patients with gross hypertrophy of the breasts are unable to lactate.

- 12 patients had children and breast fed them,
- 12 patients had children and either were unable to feed them or had had lactation suppressed with Stilboestrol,
- 18 patients were single,
- 8 patients had no family.

Nipple sensitivity was assessed (a) *Subjectively* by enquiry as to the pre- and post-operative state and the duration of any alteration in sensitivity ; and also as to erection and sexual awareness before and after operation. It was soon apparent that the latter factors carried little import for the average very phlegmatic patient suffering from gross mammary hypertrophy. (b) *Objectively*. The somatic component was assessed using the routine cotton-wool, pin-prick, and two-point discrimination tests. In this context, a control group of normal adolescent females examined in the preliminary stages of the study was found to have an average two-point discrimination of $\frac{1}{2}$ inch. Attempts to assess the automatic component by means of the Ninhydrin sweat test proved fruitless. Apart from the topographical difficulties of such procedures, repeated tests failed to show any

sweat secretion from the nipple and areola, despite recording secretion from sweat glands in the region of Montgomery's tubercles and the adjacent skin of the breast (Fig. 3). Biopsies of the areola in two cases at the time of operation confirmed that no eccrine sweat glands could be demonstrated histologically in the region of the nipple and areola. In the absence of an alternative suitable test, no further progress was found possible in this context.

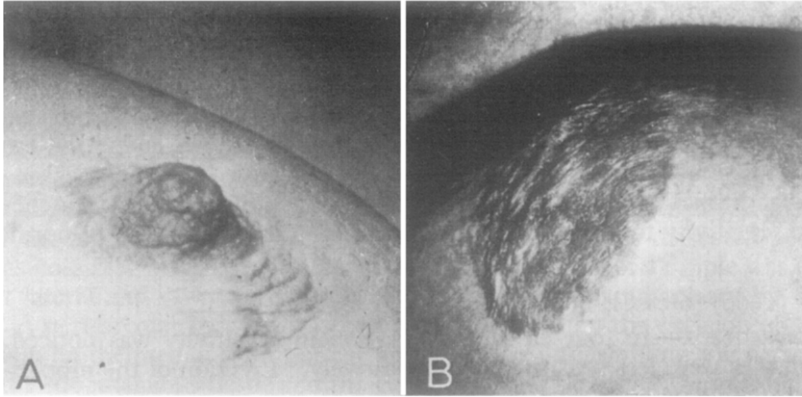


FIG. 4

Close-up view of nipple following reduction mammoplasty; A, using Skoog's dermal pedicle technique; B, rudimentary appendage not infrequently seen following free nipple transplantation where full take of graft was reported immediately post-operatively.

RESULTS

A. Techniques involving Detachment of the Nipple from the Gland

1. Free Transplantation (13 cases, 26 nipples)

(a) *Subjectively*.—Six of the patients had noticed no differences in sensitivity. One stated that sensation was impaired following operation. Six stated that they had had no sensation following operation. No patient had experienced erection of the nipples following operation.

(b) *Objectively*.—Response to cotton wool and pin-prick was normal in seven nipples, but in no case was two-point discrimination less than 1 inch. A 50 per cent. response to cotton wool and pin-prick was noted in six nipples. No sensitivity could be elicited in the remaining 13 nipples.

2. Skoog (1963): (i) 3 double pedicle cases, 6 nipples; (ii) 2 single pedicle cases, 4 nipples

(a) *Subjectively*.—(i) In one case the nipples were stated to have been numb for three to four weeks post-operatively, but subsequently to have regained normal sensitivity and to have erected occasionally. Both of the other two cases had lost all sensitivity following operation but in one case the nipples had erected.

(ii) One case reported some sensation in one nipple post-operatively.

(b) *Objectively*.—(i) No sensation to cotton wool or pin-prick was detected in any of the three cases in either nipple.

(ii) Sensation to pin-prick and cotton wool was 50 per cent, in three nipples and nil in the fourth.

Obviously no generalisation as to sensitivity can be made in view of the small

number of cases treated by this technique. It was apparent, however, that a more æsthetically acceptable nipple was more usually retained using this technique compared with the rudimentary nipple not infrequently seen following free nipple transplantation (Fig. 4, A and B).

B. Techniques retaining Nipple attached to Gland

1. *Penn I* (1955) (17 cases, 34 nipples)

(a) *Subjectively*.—In 10 cases no alteration in sensitivity was noted. In four cases sensitivity was impaired for between three and six weeks post-operatively. In three cases sensitivity was impaired following operation although in one of these diminished sensation had been noted by the patient pre-operatively. Erection had been experienced in 12 cases post-operatively, *i.e.* in all the patients who comprehended the term.

(b) *Objectively*.—Sensitivity to pin-prick and cotton wool was normal in 16 cases; two-point discrimination was $\frac{1}{2}$ inch in four cases, 1 inch in eight and $1\frac{1}{2}$ inches in three. In one case sensitivity to pin-prick and cotton wool was 50 per cent. of normal in both nipples.

2. *Penn II* (1960) (6 cases, 11 nipples)

(a) *Subjectively*.—In four cases no alteration in sensitivity was noticed. In two cases the nipples were less sensitive post-operatively. Erection of the nipples had been experienced by five patients post-operatively.

(b) *Objectively*.—Sensitivity to cotton wool and pin-prick was normal in all cases; two-point discrimination was $\frac{1}{2}$ inch in one and 1 inch in five cases.

3. *Oblique Method* (Dufourmentel and Mouly, 1961) (4 cases, 7 nipples)

(a) *Subjectively*.—No impairment had been noticed by any of the patients post-operatively. Erection of the nipples had been experienced by two patients post-operatively; the remaining patients did not comprehend the term.

(b) *Objectively*.—Sensitivity to pin-prick and cotton wool was normal in six nipples and 50 per cent. of normal in two. Two-point discrimination was $\frac{1}{2}$ inch in two, 1 inch in two and $1\frac{1}{2}$ inches in four nipples.

4. *Strömbeck* (1960, 1964) (3 cases, 5 nipples)

(a) *Subjectively*.—One case had noticed no alteration in sensitivity. One case had experienced impairment in both nipples for six months post-operatively. The remaining case sustained post-operative loss of both nipples. The first two cases had experienced erection of the nipples post-operatively.

(b) *Objectively*.—Sensitivity to cotton wool and pin-prick was normal in four nipples and two-point discrimination was $\frac{1}{2}$ inch in each.

5. *Biesenberger* (1931) (3 cases, 6 nipples)

(a) *Subjectively*.—No alteration in sensitivity was noted in one case. Loss of sensitivity in one nipple was noted in one case. Loss of sensitivity in both nipples was noted in the third case. Erection of the nipples had been experienced by the first case post-operatively.

(a) *Objectively*.—Sensitivity to cotton wool and pin-prick was normal in the three nipples corresponding to the subjective observations. Two-point discrimination in each of these was $1\frac{1}{2}$ inches.

DISCUSSION

Most previous accounts of nipple sensitivity following reduction mammoplasty appear to be based on a purely subjective evaluation. A striking feature of this limited survey has been the considerable discrepancy in many cases between the subjective and

objective findings. This is presumably partly due to the difficulty in avoiding the use of leading questions which can easily influence the patient's answer ; and also due to the fact that the degree of nipple sensitivity in many cases of gross hypertrophy pre-operatively is greatly reduced.

At the same time, a better assessment could be achieved by both pre- and post-operative assessment, as recommended by Dartigues (1935), a factor which was unfortunately not available for this series. Such a pre-operative assessment has been made, however, in cases of gross hypertrophy presenting since the review was undertaken ; and it has been apparent that in many there is a considerable diminution of nipple sensitivity probably as a direct result of the hypertrophy producing traction on the nerves supplying the nipple and areola. In one recent case, in which a reduction of 1,800 g. was achieved from each breast using the free transplantation technique, two-point discrimination of the nipple and areola pre-operatively was approximately 2 inches.

Schwarzmann (1930) emphasised that preserving a cutis bridge to the nipple left the nerve supply intact, whereas Neuffer (1938) found that microscopically the nerve supply to the nipple could be preserved intact if the skin was dissected peri-areolarly as thinly as possible. In a recent personal case, centralisation of a nipple was undertaken to correct lateral and downward displacement following mammoplasty by the oblique method. A peri-areolar incision was first made followed by the excision of an elliptical piece of skin on the medial aspect of the areola. Wide undermining was then performed between the subcutaneous tissue and the gland to enable the nipple to be moved upwards and medially to its correct position. The resulting lateral defect was closed by V-Y advancement. Sensation to pin-prick and cotton-wool was observed to be normal within 48 hours and two-point discrimination was approximately $\frac{1}{2}$ inch. This would suggest that peri-areolar incisions of themselves do not produce denervation of the nipple. This observation would appear to be supported by Ragnell's large series of cases in which sensitivity was normal in approximately 80 per cent. of cases five months following operation by his personal technique in which the whole of the gland was exposed initially by dissecting up the skin envelope.

One finding of interest in the small number of cases in the present series in which Skoog's dermal pedicle technique was employed should be mentioned. Of the three cases in which a bi-pedicle procedure was undertaken, it was found that in one case, although the nipples had remained subjectively and objectively completely anaesthetic when reviewed two years post-operatively, the patient had on several occasions experienced erection of the nipples. This would appear to suggest that this latter function depends more on the retention of the vascular pedicle and the smooth muscle within the nipple than an intact nerve supply. Erection of the nipples had not been experienced post-operatively by any of the cases of free nipple transplant studied.

CONCLUSIONS

The findings in this limited series of cases of reduction mammoplasty suggest that nipple sensitivity is retained in over 80 per cent. of cases where the nipple is left in continuity with the gland and that any disturbance of sensation following operation in these cases is usually of only a few weeks' duration. In contrast, sensitivity is present in less than 50 per cent. of cases following free transplantation of the nipples. At the same time there is evidence to suggest that in many cases of gross hypertrophy, nipple sensitivity may be considerably depressed before operation.

These findings are in conformity with the findings of the anatomical pathways of the nerve supply of the nipple as demonstrated by the macroscopic dissection of the mammary gland in 10 cadavers which formed part of this study.

The need for both subjective and objective (and ideally pre- and post-operative) assessment is emphasised in the evaluation of nipple sensitivity.

Peri-areolar incisions do not appear of themselves invariably to produce denervation of the nipple. Erection of the nipple may depend more on the preservation of an intact blood supply and the smooth muscle of the nipple than on preservation of the nerve supply.

SUMMARY

1. A report on the pathways of the nerve supply of the nipple and areola based on 10 cadaveric dissections is presented.

2. A clinical review of nipple sensitivity in 50 cases studied post-operatively following reduction mammoplasty is described.

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REFERENCES

- BIESENBERGER, H. (1931). "Deformitäten und kosmetische Operationen der weiblichen Brust." Wien : Maudrich.
- COOPER, SIR ASTLEY (1840). "The Anatomy of the Breast." London : Longman.
- DARTIGUES, L. (1935). Les anomalies du sein en dehors hypertrophies et des prolapsus. *Bull. Mém. Soc. Méd. Paris*, **139**, 575.
- DUFOURMENTEL, C. and MOULY, R. (1961). Mammoplasty by the oblique method. *Ann. chir. plast.* **6**, 45.
- ECKHARD, C. (1851). Die Nerven der weiblichen Brustdrüse und ihr Einfluss auf die Milchsecretion. *Beitr. Anat. Physiol.*, **1**, 1.
- GRAY'S *Anatomy* (1966). Thirty-fourth edition, p. 1553. London : Longman.
- GRENBABO, K.-J. (1957). *Trans. int. Soc. plast. Surg.*, First Congr., 1956, p. 375. Baltimore : Williams & Wilkins.
- GUPTA, S. C. (1965). A critical review of contemporary procedures for mammary reduction. *Br. J. plast. Surg.* **18**, 328.
- KRASKE, H. (1923). Die Operation der atrophischen und hypertrophischen Hängebrust. *München med. Wschr.* **70**, 672.
- LAST, R. J. (1966). "Anatomy, Regional and Applied", 3rd ed. London : Churchill.
- MCINDOE, A. H. (1938). Review of 80 cases of mammoplasty. *Revue Chir. struct.* **8**, 39.
- NEUFFER, M. (1938). Zur Technik der Mammoplastik. *Wien. klin. Wschr.* **51**, 1312.
- PENN, J. (1955). Breast reduction. *Br. J. plast. Surg.* **7**, 357.
- (1960). *Trans. int. Soc. plast. Surg.*, Second Congr., 1959, p. 502. Edinburgh : Livingstone.
- RAGNELL, A. (1946). Operative correction of hypertrophy and ptosis of the female breast. *Acta chir. scand. Suppl.* **113**.
- (1957). *Trans. int. Soc. plast. Surg.*, First Congr., 1956, p. 379. Baltimore : Williams & Wilkins.
- SCHWARZMANN, E. (1930). Die Technik der Mammoplastik. *Chirurg*, **2**, 932.
- SKOOG, T. (1963). A technique of breast reduction : transposition of the nipple on a cutaneous vascular pedicle. *Acta chir. scand.* **126**, 453.
- STRÖMBECK, J.-O. (1960). Mammoplasty : report of a new technique based on the two-pedicle procedure. *Br. J. plast. Surg.* **13**, 79.
- (1964). In "Modern Trends in Plastic Surgery I", p. 250, ed. Gibson, T. London : Butterworths.
- TAMERIN, J. A. (1963). The Lexer-Kraske mammoplasty : a reaffirmation. *Plastic reconstr. Surg.* **31**, 442.
- THOREK, M. (1939). Plastic reconstruction of the female breasts and abdomen. *Am. J. Surg.* **43**, 268.