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The inverted nipple: to cut the ducts or not?

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SUMMARY. **Much dilemma exists as whether to divide the lactiferous ducts or not when correcting an inverted nipple. We report a series of 26 cases (44 nipples), which have undergone correction with or without duct division. Eversion was maintained in 59% of nipples. Analysis of the failure groups revealed similar rates of failure for umbilicated nipples whether the ducts were divided (27%) or not (25%). Invaginated nipples showed an increased tendency to reinvert postoperatively if the ducts were not divided (80%) than if they were (42%) (not significant). Permanent loss of nipple sensation was noted in 20% of cases when the lactiferous ducts were divided. Postoperatively two women were able to breast feed despite complete division of their lactiferous ducts.**

Women with umbilicated nipples are usually able to breast feed. We believe that correction of the umbilicated nipple can usually be successfully performed, and function maintained without dividing the ducts. Correction of the invaginated nipple requires duct division. The underlying pathogenesis and varying methods of correction are reviewed.

Introduction

The inverted nipple is a common condition affecting at least 2% of women (Schwager *et al.*, 1974), with correction being desired by the woman not only for aesthetic reasons but in the hope of improving her ability to breast feed. Inverted nipples may be congenital, or acquired secondary to mastitis, macromastia (Schwager *et al.*, 1974) or breast reduction (Gupta, 1965). Inversion occurring secondary to carcinoma of the breast must be considered. Before embarking on corrective surgery of the inverted nipple, it is essential to differentiate the "umbilicated" nipple that can be momentarily extracted from its inverted position, from the "invaginated" nipple that cannot be forcefully extracted (Schwager *et al.*, 1974). Breast feeding is usually possible in the woman with umbilicated nipples, though often perseverance, the use of Woolwich or Netsy nipple shields (Otte, 1975), Hoffman's nipple exercises (Hoffman, 1953) or a negative suction pump (Gangal and Gangal, 1978) will be required in the perinatal period. The woman with invaginated nipples will always find difficulty and frequently be unable to breast feed. Thus when considering operative correction, the type of inverted nipple must be taken into account, so as not to compromise existing function.

Operations to correct the inverted nipple can be broadly classified into two groups depending upon whether the lactiferous ducts are divided or not. In our study we have considered whether ductal division is required to achieve adequate correction of the inverted nipple, and further to examine the effect of these procedures on nipple sensation and subsequent ability of the woman to breast feed. On the basis of our study, together with previously published works by other authors, the underlying pathogenesis and the surgical management of the umbilicated and invaginated nipples are discussed.

Materials and methods

At the Victorian Plastic Surgery Unit in the 10 years between 1978 and 1987, 35 cases of correction of the inverted nipple were performed. Nine patients were lost to follow-up. All patients were operated on by consultant plastic surgeons, with 60% of the cases being performed by one of three surgeons. Follow-up was between 6 months and 10 years, with a mean of 49 months (SD $\pm$ 33.1 months). A total of 26 female patients were studied, with a median age of 26 years (range 18–58 years). Twenty-two of the women had congenital inversion, with three acquired cases secondary to breast reduction (one inferior pedicle, one superior pedicle and one Strombeck) and one acquired case secondary to mastitis. Four patients had a past history of benign breast disease and three of nipple infections. Thirty-six percent of patients had a family history of inverted nipples. Involvement was bilateral in 69% of cases and on the left side only in the remaining 31% of cases. Thirty-four percent of the nipples were umbilicated and 66% invaginated.

The patients were classified depending upon the type of operative procedure:

(1) Ducts not divided (DND)
(2) Ducts completely divided (DCD)

Six patients (nine nipples) underwent a DND procedure. Four patients (5 nipples) underwent an operation as described by Skoog (Skoog, 1952), with excision of four triangles of areola skin alternating with four

triangles of periareolar skin based upon a circumareolar incision, whilst two patients (4 nipples) underwent correction by division of fibrous bands around the nipple base with the correction being maintained by passing horizontal mattress sutures beneath the nipple. Twenty patients (thirty-five nipples) underwent a DCD type procedure, with division of all major lactiferous ducts, insertion of a purse string suture around the nipple base and no skin resection.

Follow-up data was collected by personal interview in 19 patients and by written questionnaire in a further 7 patients. Patients were assessed as to the protrusion of their nipples, the nipples' sensitivity and response to cold and sexual arousal, and the woman's ability to breast feed pre- and postoperatively.

Results

Overall, nipple eversion was maintained in 59% of nipples, the success rate varying with the type of inverted nipple and operative procedure performed. Eversion was maintained in 4 of the 5 nipples (80%) corrected by a Skoog type procedure, and none of the 4 nipples treated by the other DND method. Twenty-two of the 35 nipples (63%) corrected by a DCD procedure everted (Table 1). Reinversion occurred in 14 nipples (32%), with "flat nipples" resulting in a further 4 cases (9%). Analysis of the failure groups (reinversion and flat nipples) revealed similar rates of failure for umbilicated nipples whether treated by DND (25%) or DCD (27%) procedures. Invaginated nipples showed an increased tendency to reinvert postoperatively if corrected by a DND type procedure (80%) compared to a DCD procedure (42%), however this did not reach significance. Reinversion occurred between the second postoperative day and 3 months. The four "flat nipples" were all of the invaginated type and underwent a DCD procedure where sufficient nipple bulk to produce eversion was not obtained intraoperatively. (Figs 1 and 2).

Postoperative complications included the development of a wound haematoma in one patient within 24 hours of operation that required operative evacuation. An alteration in nipple sensation was noted by 42% of the patients, ranging from temporary (less than 6 months) to permanent (greater than 3 years) loss of sensation and in one case hyperaesthesia of the nipple (Table 2). In the DND group, 33% of patients had altered nipple sensation (0% permanent), compared to 45% in the DCD groups (20% permanent). Response of the nipple to cold and sexual arousal was diminished temporarily (less than 6 months) in 12% of cases and permanently (greater than 3 years) in a further 12%. There was no relationship between type of operation and diminished response. No woman developed any long term complications post correction, such as breast abscess, retention cysts or carcinoma.

Prior to correction of their inverted nipple nine women had children, seven of whom had attempted to breast feed. Two women with umbilicated nipples successfully breast fed, their nipples everting with lactation. The remaining five women with invaginated nipples were unable to breast feed, despite the use of nipple exercises, breast pumps and nipple shields.

Postoperatively five women had children. Two did not attempt to breast feed on the advice of their surgeons. The other 3 women had a DCD type procedure and subsequently had varying success with breast feeding. One woman who had correction of umbilicated nipples was able to successfully breast feed noting however that milk flow was approximately 50% slower than when she had lactated prior to operative correction. The second woman with invaginated nipples developed postoperative reinversion but was able to breast feed with the aid of nipple shields. The third woman (umbilicated nipples) attempted, but was unable to breast feed. No woman post correction developed mastitis in the puerperium.

Discussion

Crucial to the understanding of the pathogenesis and thus the treatment of the inverted nipple is the embryology of the nipple-areolar complex. The mammary gland including the nipple-areolar complex begins to develop at the fifth week of gestation as a thickening in the ectoderm, the mammary ridge. Inward growth of the ectoderm into the mesenchyme occurs in the eighth week, with subsequent regression of the protrusion of the overlying skin. This ectodermal downgrowth is initially a solid bud which later canalises to form the lactiferous ducts (20–32 weeks). Thus from the tenth week onwards the nipple appears as a pit in the ectoderm and it is only at or soon after birth that mesenchymal proliferation under the pit produces protrusion of the nipple, with further elevation occurring at puberty (Vorherr, 1974). Lack of this mesenchymal proliferation is thought to be a major factor in producing the inverted nipple. Schwager *et al.* (1974), in a study of postmortem and radical mastectomy specimens, found inverted nipples in 6 of the 339 specimens examined. Histological sectioning

Table 1 Overall results for correction of inverted nipples
Number of nipples (%).

	DND (Skoog)		*DND (Other)*		*DCD*		
	*Umbil.**	*Invag.†*	*Umbil.*	*Invag.*	*Umbil.*	*Invag.*	*Total*
Nipple Eversion	3	1	—	—	8	14	26 (59%)
Flap nipple	—	—	—	—	—	4	4 (9%)
Reinversion	1	—	—	4	3	6	14 (32%)

*Umbilicated. †Invaginated

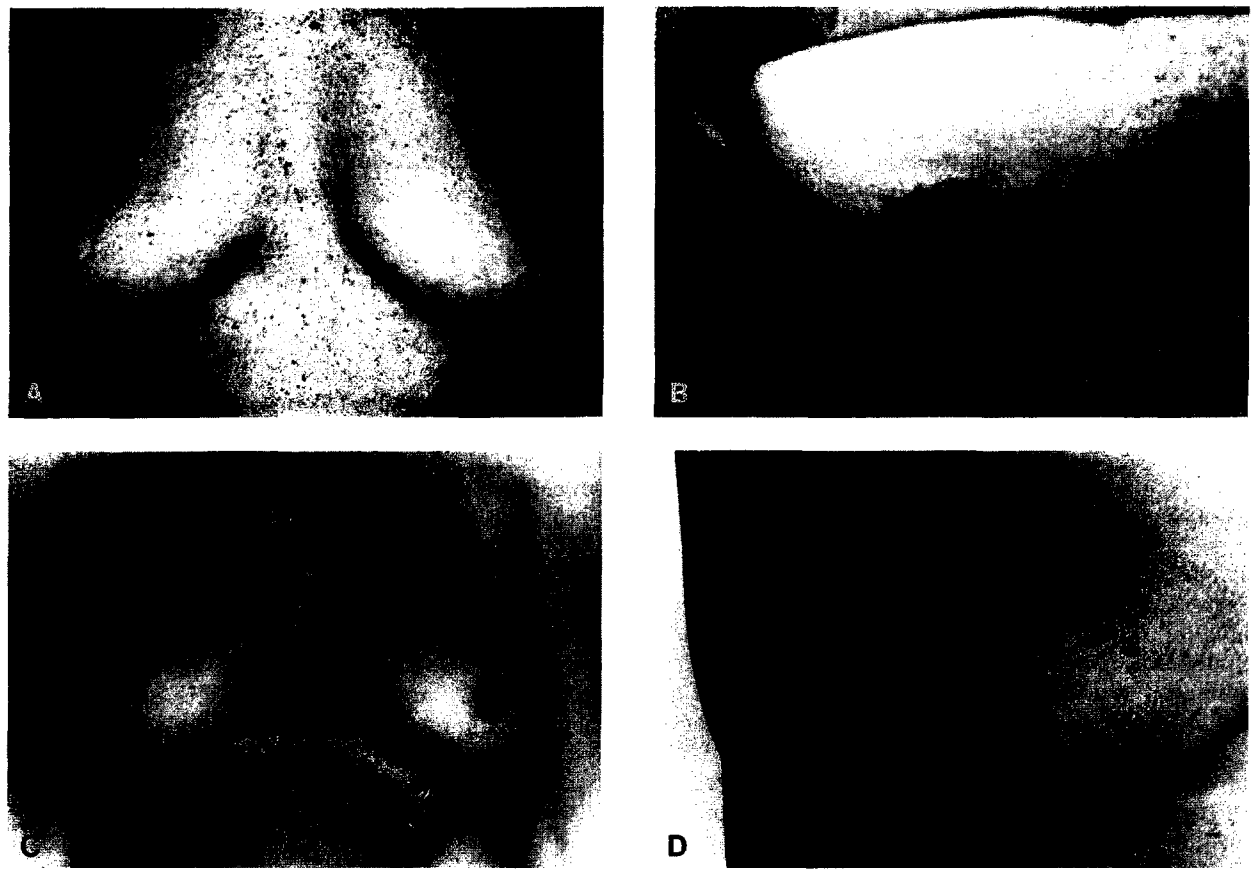

Fig. 1

Figure 1—(A, B) Preoperative view of 28-year-old woman with bilateral invaginated nipples. (C, D) Six months post correction of inverted nipples by complete division of lactiferous ducts and insertion of purse string suture. Good nipple projection is maintained.

of normal nipple showed that the thickness of dense connective tissue beneath the nipple is approximately double that found beneath the areola. In the inverted nipple however, there was no significant difference in the thickness of dense connective tissue beneath the nipple and areola, thus suggesting that protrusion of the normal nipple is simply due to the greater bulk of dense connective tissue. Schwager *et al.* (1974) also noted that nipple eversion was only possible after excision of the dense connective tissue at the nipple-areolar junction and transecting the ducts alone did not permit the inverted nipple to evert. Conversely, Schwager *et al.* (1974) and Ramakrishnan and Rao (1980), in their clinical series noted that in some patients with invaginated nipples, after dividing the tissues at the nipple-areolar junction, complete correction of the inversion could not be achieved until all lactiferous ducts were divided thus indicating the presence of short or hypoplastic ducts.

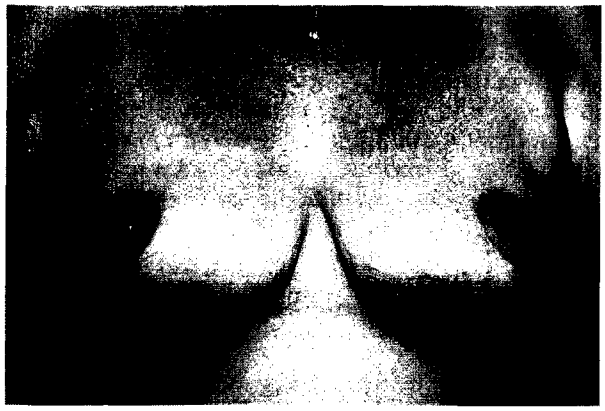

Fig. 2

Figure 2—Six months post correction of inverted nipples by complete ductal division and simultaneous breast reduction. Postoperatively the left nipple reinverted and the right nipple was flat.

The umbilicated nipple

The woman with umbilicated nipples has adequate ductal "length" as evidenced by the fact that the nipple can be fully everted preoperatively and that

Table 2 Alteration in nipple sensation
Number of patients (%).

	DND	*DCD*	*Total*
Normal	4	11	15 (58%)
Altered sensation			
Temporary Hypoaesthesia*	2	4	6 (23%)
Permanent Hypoaesthesia†	0	4	4 (15%)
Hyperaesthesia	0	1	1 (4%)

* < 6 Months. † > 3 Years

once the nipple is mobilised on its base (by dividing the dense connective tissue at the nipple-areolar junction and any tight periductal fibrous bands) it can be easily everted without obvious tethering by the ducts (Schwager *et al.*, 1974). However eversion is not maintained due to the underlying deficiency of connective tissue bulk beneath the nipple. In our series reinversion rates were similar (25% and 27%) whether the ducts were divided or not, supporting this observation. Further supporting evidence is found for the adequacy of ductal length in the post partum woman with umbilicated nipples. Nipple eversion is obtained and maintained during this period, thus allowing the infant to suckle. This is said to be due to a "loosening of adhesions at the nipple base" (Hoffman, 1953) and it would seem likely that nipple bulk is maintained by milk collecting in the lacteal sinuses. When correcting the inverted nipple without division of the ducts, nipple sensation may be temporarily reduced, but permanent loss of nipple sensation is unlikely. Successful breast feeding post DND procedures has been reported by Skoog (1952) and Wolfort *et al.* (1978). Thus for the woman with umbilicated nipples correction should be performed without need for the ducts to be divided, minimising any sensory loss or reduction in the ability to breast feed in the future.

Many techniques have been proposed to correct the inverted nipple without division of major lactiferous ducts. Early methods such as those proposed by Kehrer in 1879, (Schwager *et al.*, 1974), Axford (1889), Sellheim (1917), Skoog (1952), Spina (1957), and Wolfort (1978) require a number of areola incisions and relocation of the areola skin to around the nipple base without correction of the underlying pathology, thus resulting in significant scarring and deformity of the nipple-areolar complex as exemplified by our patient in Figure 3. As many of the women seeking correction are doing so for aesthetic reasons, this is a major disadvantage. Division of the areola muscle has been suggested by a number of authors, but most have found this to be an unsatisfactory procedure with a high recurrence rate (Basch, 1893; Ramakrishnan and Rao, 1980), except for Wolfort *et al.* (1978) who combined myotomy with insertion of a purse-string suture and a VY skin advancement. Schwager *et al.* (1974), Ramakrishnan and Rao (1980), and Hauben and Mahler (1983) described a technique that involved dividing the fibrous tissue at the nipple-areolar junction via a periareolar or nipple-areolar junction incision, thus raising the nipple on a pedicle of ducts and then maintaining nipple eversion by placing a purse-string suture around the nipple pedicle. Their methods are technically difficult but provide a cosmetically acceptable result. Of importance with their methods is the correct placement of the purse-string suture, if too superficial it may erode through the skin or if too tight it may garotte the ducts. Elsahy (1976), and Yanai *et al.* (1986) described a similar technique involving release of periductal fibrous bands, but with enhancement of nipple bulk by tunnelling local dermal flaps through the nipple pedicle. This technique places small incisions across the areola but does consider the important aspect of increasing nipple bulk and therefore should be considered the method of choice.

The invaginated nipple

The invaginated nipple presents us with a different problem in that once the dense connective tissue at the nipple-areolar junction is divided, the ducts may still tether the nipple in its inverted position, and only by dividing the ducts will the nipple be allowed to evert (Schwager *et al.*, 1974; Ramakrishnan and Rao, 1980). Other authors (Waller, 1947; Broadbent and Woolf, 1976; Rayner, 1980) have also alluded to the concept of "hypoplastic ducts" in the invaginated nipple, thus limiting the potential of any operation to improve the function of the nipple. In our series we showed a greater tendency for invaginated nipples to reinvert postoperatively if the ducts were not divided (80%) compared to when the ducts were divided (42%), indicating that in some patients the presence of short ducts may be a factor in maintaining the inversion.

Personal communications, by midwives, indicate that women with invaginated nipples occasionally are able to breast feed, though none of the women preoperatively in our series were able to do so. The

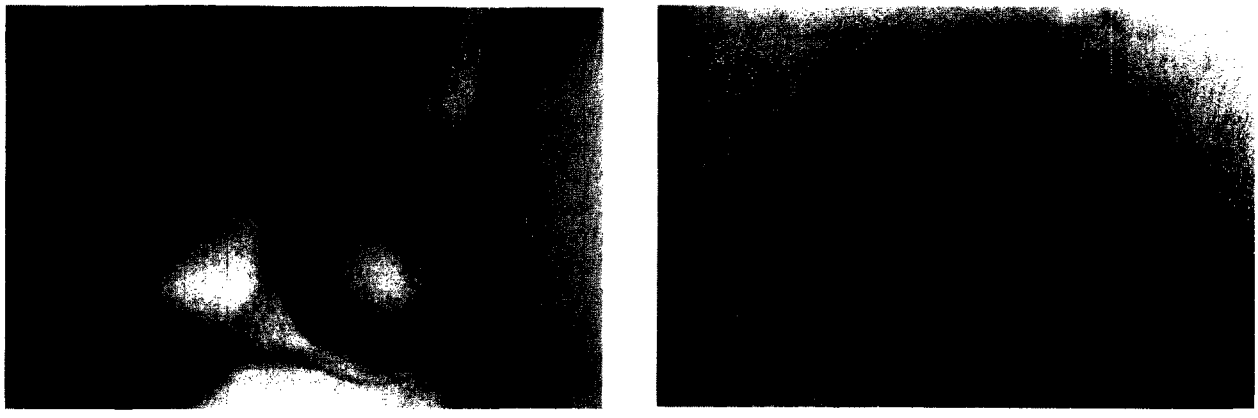

Fig. 3

Figure 3—(A, B). A 26-year-old woman, 2 years post correction of left inverted nipple by Skoog technique. Note significant scarring, reinversion and 15 mm reduction in areola diameter.

ability to breast feed is multifactorial depending upon the degree of nipple inversion and ductal hypoplasia, how vigorously the infant sucks, the amount of assistance the mother receives, and how long she wishes to persevere. Therefore there is no way to predict whether a woman with invaginated nipples will be able to breast feed or not. Further impedance of the women's ability to breast feed would conceivably occur if the ducts were then divided to correct the invaginated nipple. If it is "essential" for the woman to breast feed, then correction should be deferred until the woman has at least attempted to breast feed with her first infant and only then if this attempt was unsuccessful.

Of interest was the ability of the two women in our series to breast feed post DCD, conceivably due to some reformation and recanalisation of the lactiferous ducts. However until greater numbers of women have been followed up in the long term, one must assume that the ability to breast feed is reduced after complete division of the lactiferous ducts.

Thus, correction of the invaginated nipple is best achieved by complete division of the ducts. Much of the recent literature has addressed the secondary problems of maintenance of eversion and lack of nipple bulk. Methods include those proposed by D'Assumpçâo and Rosa (1977), where eversion is maintained by resecting quadrilaterals of skin with their short diagonals based upon the nipple-areolar junction, thus narrowing the nipple base. Hartrampf and Schneider (1976) maintained eversion by passing horizontal mattress sutures through the nipple, whilst Morris *et al.* (1980) closed the dead space beneath the nipple to preclude retraction. Hamilton (1980), and Crestinu (1987) both proposed methods that increase nipple bulk by a local advancement of fibroductal tissue and maintain eversion by suturing deep tissues beneath the nipple, obliterating the cavity and projecting the nipple forwards (*i.e.*, a three dimensional rotation or V–Y advancement flap). Other methods involve the use of local dermal flaps (Teimourian and Adham, 1980; Hinderer and Del Rio, 1983; Haeseker, 1984), local flaps of breast tissue (Broadbent and Woolf, 1976; Rayner, 1980) or free cartilage grafts (Brent and Bostwick, 1977). The disadvantage with these latter procedures is that breast feeding will be further impaired and may become impossible especially if tissue flaps or cartilage grafts are interposed between the cut ends of the ducts.

Alteration in nipple sensation especially when permanent is of special concern. Forty-five percent of women who had DCD operations noted altered nipple sensation with 20% complaining of permanent loss of nipple sensation. This permanent sensory loss in the DCD group is probably related to the division of the periductal sensory nerves when dividing the lactiferous ducts, in addition to partial division of the subdermal plexus by the skin incision.

Apparent recurrence rates in the literature are greatest for myotomy procedures and lowest for procedures involving complete ductal division, though many papers are poorly documented as to exact numbers and results. At the Victorian Plastic Surgery Unit recurrence rates were high overall (41%), with a 25% recurrence rate for umbilicated nipples irrespective of type of procedure, 80% for invaginated nipples if the ducts were not divided and 42% if the ducts were divided. This high recurrence rate, even when the ducts are divided, is probably due to the failure of the operative procedure to correct the underlying pathology. The three major pathological abnormalities contributing to nipple inversion are lack of dense connective tissue beneath the nipple, dense connective tissue tethering at the nipple-areolar junction, and short ducts. The DCD technique deals with the latter problem of short ducts, however not always with the first two. The DCD technique involved making a small incision at the nipple-areolar junction, eversion of the nipple with a traction suture, and then passing a scalpel blade horizontally beneath the nipple to divide the ducts. The fibroductal tissue being tethered at the nipple base, is simply stretched by forceful eversion of the nipple, with no increase in nipple bulk occurring. No specific attempt was made to release the dense connective tissue at the nipple-areolar junction, though some division would automatically occur during division of the lactiferous ducts. The "other" DND technique similarly, did not correct the problem of lack of nipple bulk, and was applied to patients with invaginated nipples that would otherwise require ductal division to obtain eversion, and was thus associated with a universal failure rate.

Conclusion

If the woman has umbilicated nipples and desires to maintain the possibility of being able to breast feed, then continuity of ducts should be aimed for. Techniques involving skin resection alone have the marked disadvantages of scarring, deformity and high recurrence rate and thus should not be considered. Division of the dense connective tissue at the nipple-areola junction, and any tight periductal fibrous bands with augmentation of nipple bulk by dermal flaps tunnelled through the duct pedicle (Elsahy, 1976), will offer the woman the chance to breast feed as well as providing an acceptable cosmetic appearance. Alternatively, the method as described by Schwager *et al.* (1974), provides a satisfactory result but is technically more difficult.

For the woman with invaginated nipples the operation of choice to allow for total correction of the underlying deformity is complete division of the ducts with a local V–Y type advancement of fibroductal tissue, well illustrated by Crestinu (1987). If intraoperatively adequate nipple projection is still not obtained, dermal flaps may be raised to further increase nipple bulk (Teimourian and Adham, 1980). Most importantly though the patient should be warned preoperatively about the possibility of permanent reduction in nipple sensation, and the probable further impairment of her ability to breast feed. If she has a sincere desire to breast feed then surgery should be postponed until she has attempted to breast feed her first infant and failed to do so.

References

Axford, W. L. (1889). Mammillaplasty. *Annals of Surgery*, **9**, 277.

Basch, K. S. (1893). Zur anatomie und physiologie der brustwarze. *Archiv Für Gynaekologie*, **44**, 15.

Broadbent, T. R. and Woolf, R. M. (1976). Benign inverted nipple: Trans-nipple-areolar correction. *Plastic and Reconstructive Surgery*, **58**, 673.

Brent, B. and Bostwick, J. III (1977). Nipple-areola reconstruction with auricular tissues. *Plastic and Reconstructive Surgery*, **60**, 353.

Crestinu, J. M. (1987). The inverted nipple; A blind method of correction. *Plastic and Reconstructive Surgery*, **79**, 127.

D'Assumpção, F. A. and Rosa, E. M. S. (1977). Correcting the inverted nipple. *British Journal of Plastic Surgery*, **30**, 249.

Elsahy, N. I. (1976). An alternative approach for inverted nipple. *Plastic and Reconstructive Surgery*, **57**, 438.

Gangal, H. T. and Gangal, M. H. (1978). Suction method for correcting flat nipples or inverted nipples. *Plastic and Reconstructive Surgery*, **61**, 294.

Gupta, S. C. (1965). A critical review of contemporary procedures for mammary reduction. *British Journal of Plastic Surgery*, **18**, 328.

Haeseker, B. (1984). The application of de-epithelialised "turn-over" flaps to the treatment of inverted nipples. *British Journal of Plastic Surgery*, **37**, 253.

Hamilton, J. M. (1980). Inverted nipples. *Plastic and Reconstructive Surgery*, **65**, 507.

Hartrampf, C. R. Jr and Schneider, W. J. (1976). A simple direct method for correction of inversion of the nipple. *Plastic and Reconstructive Surgery*, **58**, 678.

Hauben, D. J. and Mahler, D. (1983). A simple method for the correction of the inverted nipple. *Plastic and Reconstructive Surgery*, **71**, 556.

Hinderer, U. T. and Del Rio, J. L. (1983). Treatment of the postoperative inverted nipple with or without asymmetry of the areolar. *Aesthetic Plastic Surgery*, **7**, 139.

Hoffman, J. B. (1953). A suggested treatment for inverted nipples. *American Journal of Obstetrics and Gynaecology*, **66**, 346.

Morris, A. M., Rai, Y. S. and Lamont, P. M. (1980). A method for correcting the inverted nipple. *British Journal of Plastic Surgery*, **33**, 41.

Otte, M. J. (1975). Correcting inverted nipples—An aid to breast feeding. *American Journal of Nursing*, **75**, 454.

Ramakrishnan, K. M. and Rao, D. K. (1980). Congenital inversion of the human nipple. *Aesthetic Plastic Surgery*, **4**, 65.

Rayner, C. R. (1980). The correction of permanently inverted nipples. *British Journal of Plastic Surgery*, **33**, 413.

Schwager, R. G., Smith, J. W., Gray, G. F. and Goulian, D., Jr. (1974). Inversion of the human female nipple, with a simple method of treatment. *Plastic and Reconstructive Surgery*, **54**, 564.

Sellheim, H. (1917). Brustwarzenplastik bei hohlwarzen. *Zentralblatt für Gynäkologie*, **41**, 305.

Skoog, T. (1952). An operation for inverted nipples. *British Journal of Plastic Surgery*, **5**, 65.

Spina, V. (1957). Inverted nipple—contribution to the surgical treatment. *Plastic and Reconstructive Surgery*, **19**, 63.

Teimourian, B. and Adham, M. N. (1980). Simple technique for correction of inverted nipple. *Plastic and Reconstructive Surgery*, **65**, 504.

Vorherr, H. (1974). *The Breast: Morphology, Physiology, and Lactation*. New York, Academic Press. Chapter 1.

Waller, H. (1947). Incidence, causes and prevention of failure of breast feeding. *British Medical Bulletin*, **5**, 181.

Wolfort, F. G., Marshall, K. A. and Cochran, T. C. (1978). Correction of the inverted nipple. *Annals of Plastic Surgery*, **1**, 294.

Yanai, A., Okabe, K. and Tanaka, H. (1986). Correction of the inverted nipple. *Aesthetic Plastic Surgery*, **10**, 51.

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