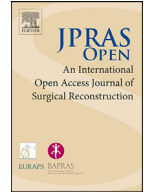


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Review

Current surgical techniques for nipple reduction: A literature review

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ABSTRACT

Background: Macrothelia, enlarged nipples, is a relatively uncommon condition causing psychological distress in both sexes. However, to date, there is no comprehensive comparison of the spectrum of surgical techniques for nipple reduction. This review summarises the current practices to guide surgical approach to macrothelia.

Methods: A literature review was performed using the PubMed database by searching for the following words: nipple areola plasty OR nipple areola complex plasty OR nipple areola reduction OR nipple areola complex reduction OR nipple areola hypertrophy OR nipple areola complex hypertrophy OR nipple-areola complex hypertrophy OR macrothelia AND techniques OR classification OR indications OR treatment OR reduction. Additional articles were selected after reviewing references of identified articles.

Results: Thirty articles were selected after applying inclusion criteria to identify prospective and retrospective studies evaluating and/or describing different techniques, outcomes, complications and patient satisfaction. Reduction of the nipple was described in 639 patients, 582 females and 57 males. The thirty articles selected were case reports and clinical observations. No systematic or un-systematic reviews were found. Five different techniques were described, namely, circumcision, amputation, wedge resection, simple grafting and flaps. Patient satisfaction rates were high. Only a few cases documented sustained ability to breastfeed after the procedure. Complication rates were low and mentioned in only few studies.

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Conclusion: All techniques resulted in high patient satisfaction and low complication rates. However, current practices are exceedingly diverse, and there is currently no common classification system, which makes comparison between surgical techniques for nipple reduction challenging. The choice of surgical technique must be based on individual assessment. Clinical guidelines are challenging owing to the heterogeneity of the studies reviewed.

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Introduction

Macrothelia, enlarged nipples, is a relatively uncommon condition with an unknown aetiology.¹ Hypertrophy or over-projection of the nipple (in ancient Greek 'long nipples'; [Figure 1](#)) causes psychosocial distress. Few studies describe the normal average nipple/areola proportion, and consensus on surgical practice of the management of macrothelia does not exist. In one study, the nipple:areola proportion was described as 1:3 in 37 Caucasian women with an age range of 24–64 years and a BMI range of 20.4–30.8 kg/m². These women had not previously undergone breast surgery, and they were not pregnant or menstruating or taking hormone replacement therapy at the time of assessment.² In another study, a normal nipple was described as less than 10 mm in diameter and less than 8 mm in height.³ Lai and Wu reported that in cases of hypertrophy, nipples may exceed 2 cm and gain a spherical form.⁴ Hypertrophy may be regarded based on height and/or width.

van Wingerden suggested that the aesthetically pleasing nipple/areola ratio is approximately 1:3.6 in healthy white females, aged 20–31 years (mean 25.5 years) and suggested calculation of wedge width to be resected of relative wide nipples by using the formula $2\pi r$.⁵ For unknown reasons, macrothelia is more common in Asian than in Caucasian women.^{4,6} Nipple reduction is also a matter of consideration in chest surgery in female-to-male transgender surgery.^{7–12}

Several methods for surgical correction of macrothelia are described. However, no consensus exists on the preferred methods for nipple reduction. The present study discusses the currently used surgical techniques for nipple reduction in males and females.

Materials and methods

We performed a literature review to summarise current surgical techniques for macrothelia. Articles concerning nipple reduction alone were included. The words chosen for search were ((nipple areola plasty) OR (nipple areola complex plasty) OR (nipple areola reduction) OR (nipple areola complex reduction) OR (nipple areola hypertrophy) OR (nipple areola complex hypertrophy) OR (nipple-areola complex hypertrophy) OR (macrothelia)) AND ((techniques) OR (classification) OR (indications) OR (treatment) OR (reduction)). Articles written in foreign language (other than English) were omitted.

Results

The search resulted in 30 articles found eligible for review: Three case reports, 24 original research papers and three correspondence (letters) from 1974 through 2017 ([Table 1](#)). The 30 articles included case series of a total of 639 patients, 582 females and 57 males. All of the articles relied on clinical observations.

Five different techniques were described, namely, circumcision, amputation, wedge resection, grafting and flap techniques ([Figure 2](#)), of which the latter was most frequently used. Examples of the

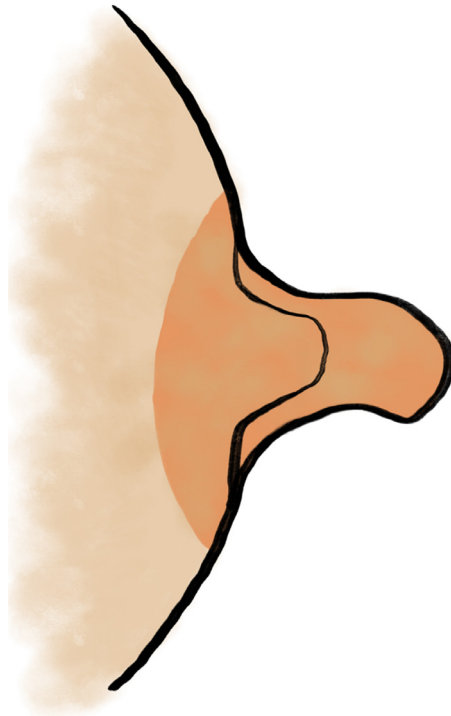


Figure 1. Macrothelia is the enlargement of the nipple – here illustrated by over-projection compared to a normal nipple. Illustration by I. Saltvig.

techniques are illustrated in [Figure 3](#). All nipple reductions were bilateral. In some cases, mini reviews were combined with a presentation of a novel surgical method to reduce nipples. Meta-analysis was not applicable due to the heterogeneity of the studies reviewed.

Circumcision of hypertrophic nipples was first described by Regnault in 1975¹ and modified in 1996 by Lai and Wu.⁴ Using this technique, a collar of skin is removed, but all ductal elements and the tip is preserved. However, it removes dermal tissue potentially compromising vascular flow and lymphatic drainage.¹³ Fanous et al. aimed for the ideal nipple by a modified circumcision method.¹⁴ Baxter performed a circumferential incision at the base of the nipple for reduction to conceal scars better in 15 women requiring nipple or areola reduction and simultaneous breast augmentation.¹⁵

Amputation

In 2010, Kim and Hwang presented a technique applicable for height reduction by local excision and simple buried purse-string suture for 19 women. Fourteen of the 19 women enrolled were satisfied with the final nipple height. Nipple sensation was not checked before surgery, but complete recovery of sensation was reported one month after surgery. Ability to breastfeed was not addressed in this publication.¹⁶ Moliver et al. excised the top of the nipple in 29 females and 1 male and reportedly obtained satisfactorily aesthetic results.¹⁷ In 2009, Kerr-Valentic and Agarwal also suggested a crown excision after total skin-sparing mastectomy in one patient in.¹⁸ Tuncer et al. proposed a somewhat-alike de-epithelialisation technique, which allegedly did not compromise vascularity.¹⁹ Sim and Sun presented the excision of a Chullo-Hat-like tissue bloc, which could be applied in men and women who have ceased childbearing.²⁰

Table 1

From 1974 to 2017, thirty articles describe surgical correction of macrothelia.

Author(s)	Type of study	Method	Patients included
Basile and Chang	Three triangular flaps +/- core resection	Research article	15 f
Baxter	Circumferential skin excision	Research article	15 f
Cheng et al.	Modified top hat flap	Research article	19 f
Debono and Rao	Sinusoidal flaps	Research article	2 m
Fanouso et al.	Circumcision	Research article	15 f
Ferreira	Flap design – three longitudinal + one horizontal excision	Research article	Not disclosed
Frederick et al.	Central resection and flaps	Research article	Not disclosed
Hage and van Kesteren	Resection	Research article	Not disclosed
Huang et al.	Three dermal flaps	Research article	43 f
Jin and Lee	Circumcision and wedge resection	Research article	247 f, 10 m
Kerr-Valentic	Crown resection	Communication	1 f
Kim and Hwang	Amputation	Research article	19 f
Labove and Davison	Combined base imbrication and top hat reduction	Letter	1 f
Lai and Wu	Modified circumcision	Research article	6 f
Lee and Withers	Geometric circumcision	Research article	18 f
Moliver et al.	Amputation	Research article	29 f, 1 m
Monstrey et al.	Subtotal resection	Research article	Not disclosed
Marshall	Core excision + four flaps for reconstruction	Case report	1 m
Mu et al.	Modified wedge resection	Research article	42 m
Nelson et al.	Free nipple grafts	Research article	Not disclosed
Regnault	Cylindrical excision including superficial musculature	Research article	16 f
Ren et al.	Three-dimensional Z-shaped incision	Research article	22 f
Sim and Sun	Crown resection	Research article	53 f
Sperli	Flap design – Vertical and square excisions	Research article	1 f
Takayanagi and Nakagawa	Flaps	Research article	21 f
Tuncer et al.	Circumferential excision, de-epithelialisation	Letter	4 f
van den Berg and van der Lei	Yin-Yang flap technique, modified sinusoidal technique	Case report/review	1 m
van Wingerden	Wedge resection	Research article + case report	20 f
Vecchione	Amputation	Case report	1 f
Yu et al.	Windmill flaps	Research article	16 f

Wedge resection

In accordance with Sperli and colleagues,²¹ Ferreira and colleagues suggested a technique in which the central column is preserved. By marking three ellipses and horizontal circles, the nipple is reduced in height and width, and the authors claim minimum scarring to the nipple; however, no clinical photos were presented to substantiate this.²² Ren et al. developed a three-dimensional Z-shaped incision technique to 22 healthy women of age 18 to 42 years.²³ Additionally, Lee and Withers²⁴ and Mu et al.²⁵ suggested a modification of wedge resection. The procedure suggested by Mu et al. is useful when performing free nipple graft reconstructions on the contralateral side in patients who have had a breast reconstruction. The method is simple and quick, and mean duration of the procedure is 16.5 min. It involves incising the base of the nipple at the junction with the areola from the 3-o' clock position to the 9-o' clock position and then making a vertical incision through the nipple (connecting the 9–3 o' clock positions), thereby removing the inferior half. The nipple is closed over by folding the superior half onto the denuded half of the nipple base, thereby reducing projection but maintaining the circumference. Its disadvantage is destruction of the ducts, but this is not usually an issue for those undergoing nipple reconstruction as part of a breast reconstruction.

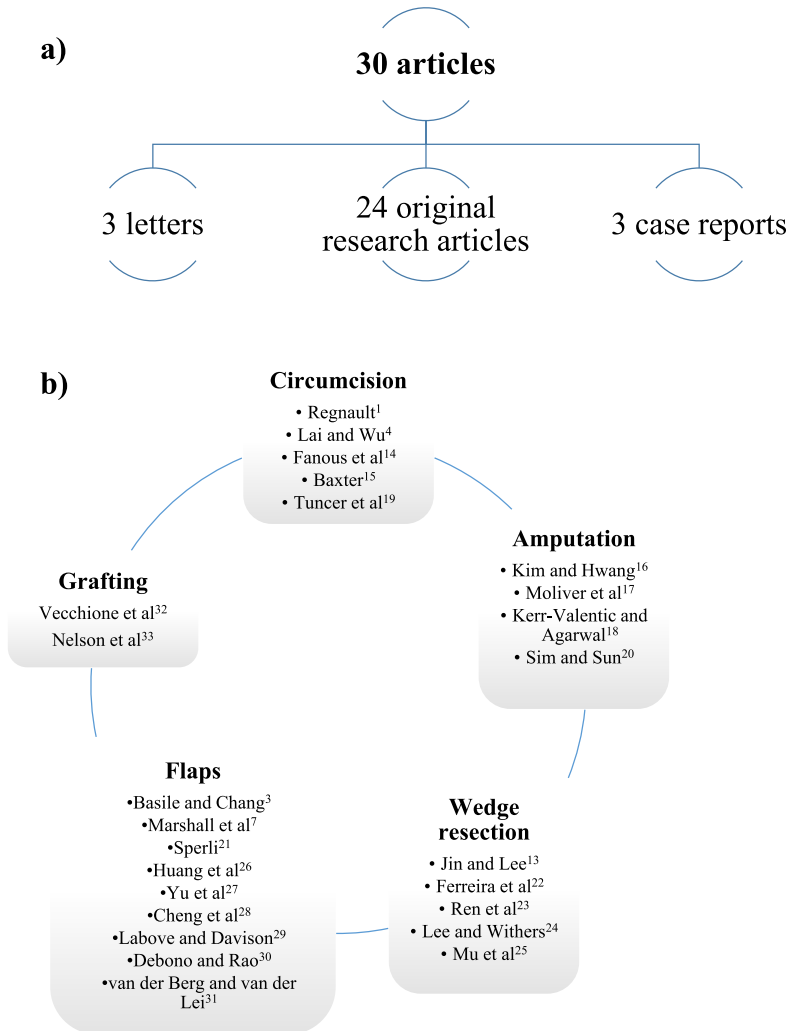


Figure 2. Literature search yielded 30 articles, in total describing 639 patients undergoing surgical correction of macrothelia. (a) Thirty articles described the five techniques (b) Examples of the techniques.

Flaps

Basile and Chang suggested an elegant but rather complicated triple-flap reduction that preserved erectile function and sensitivity and which could be used in cases of longer and broad nipples. Effect on the ability to breastfeed was not described, but the central core of the nipple is removed, which could limit the applicability of the technique to females of parity.³ Huang et al. suggested a geometric incision procedure to reduce height and diameter in nipple hypertrophy.²⁶ A windmill flap procedure was suggested by Yu et al. It preserves the lactiferous ducts, and scars are visible; however, the authors claim that this is the only technique available for concomitant areola reduction.²⁷

The Top Hat principle was introduced by Cheng et al., who demonstrated preserved sensibility of the reduced nipples by monofilament testing. By this technique, a crescent-shaped section of skin

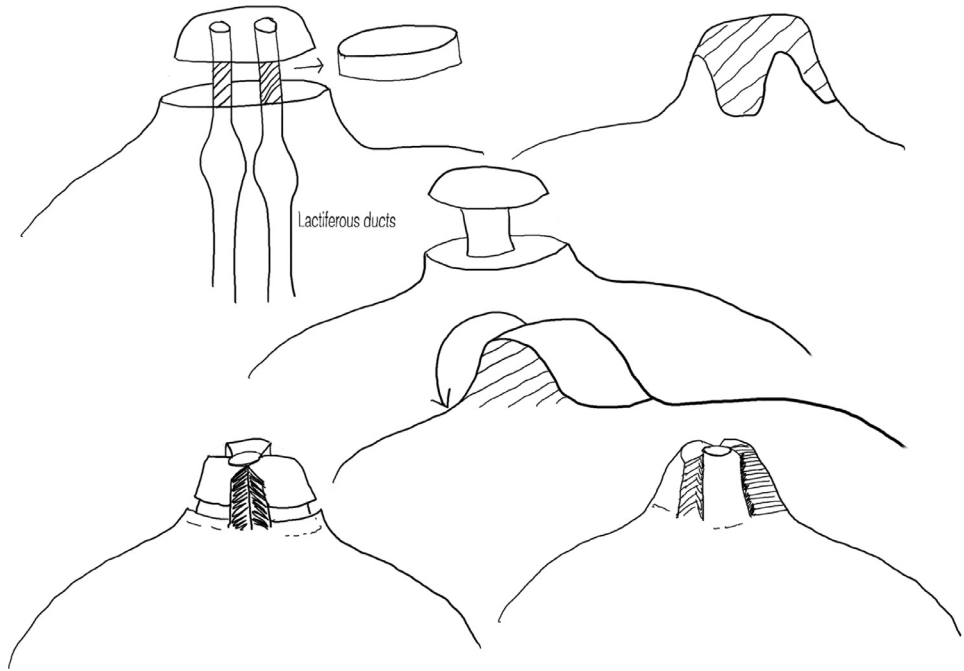


Figure 3. Examples of surgical techniques for reduction of macrothelia.

Top left: Amputation

Top right: Flaps

Middle top: Circumcision

Middle bottom: Wedge resection

Bottom left: Wedge resection + circumcision

Bottom right: Wedge resection

Illustration by I. Saltvig.

below the ne nipple is excised. Stromal tissue, including the lactiferous ducts, is trimmed to reduce height and width. Subcutaneous flaps are sutured locally.²⁸ The Top Hat method was modified in 2014 by combining it with base imbrication.²⁹ Debono and Rao suggested a sinusoidal excision technique for male nipple hypertrophy to reduce height.³⁰ This method was later modified by van den Berg and van der Lei to avoid dog ears.³¹ Marshall et al. reported a single case of appropriate core excision, and by raising 4 flaps, they were able to reconstruct a small nipple in a male.⁷

Grafting

Vecchione published a method to reduce height in hypertrophic nipples first by simple amputation, followed by grafting of very thin split-thickness graft from the tip of the nipple.³² Nelson et al. reported high patient satisfaction after reduction mammoplasty and nipple reduction by free nipple grafts in 16 female-to-male transgender patients.³³

Discussion

Macrothelia, over-projecting nipples, is an uncommon but psychologically challenging problem for women and men. As expected, male patients are a different subset of patients for whom only appearance is an important outcome. No systematic reviews of surgical techniques for nipple reduction or guidelines for clinical decisions exist.

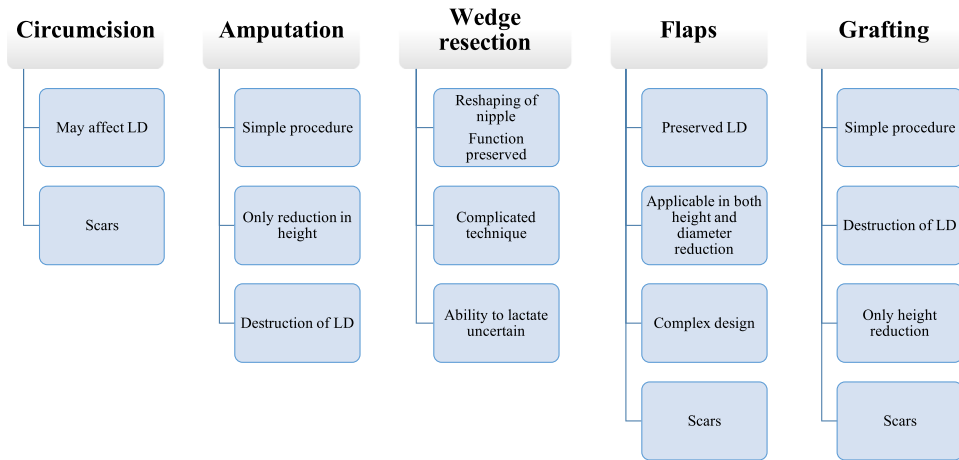


Figure 4. Advantages and disadvantages of current surgical techniques for nipple reduction.

We reviewed 30 articles to describe five different current surgical techniques for nipple reduction. The risk of bias is high in unsystematic reviews; however, the heterogeneity of study designs and (lack of) assessment of eventual post-operative outcome did not allow meta-analysis to suggest guidelines for the surgical treatment of macrothelia. Overall, it is difficult to compare functional and aesthetic outcomes of the different techniques. Simple amputation affects the ability to breastfeed and may not result in normal projection of the nipple. Circumcision and grafting also damage the lactiferous ducts, and they probably produce scarring. Wedge resection and flap techniques aim to overcome these challenges but describe in most cases rather complicated techniques. Advantages and disadvantages of the five techniques are illustrated in [Figure 4](#).

Few adverse effects were described in the 30 articles. In most cases, adverse effects were only briefly mentioned. Outcome was in few of the studies reported by questionnaires completed by patients, but in most cases, authors concluded the post-operative results, eventually blurring objective assessment. Unaesthetically satisfactory results or scarring/contracture were not described in any of the studies. Post-operative complications such as hematoma, delayed healing and infections were reported in only few of the studies (e.g. 12). Some women were not pleased with the aesthetic outcome and went through reoperations. Ability to breastfeed was only briefly mentioned in a few of the studies.

The ideal nipple has a cylindrical shape and a ‘dome-like’ curved top.¹⁴ The areola/nipple ratio varies with parity, age, BMI and hormone status. To reach an optimal aesthetic outcome of surgical nipple reduction, it is imperative to determine the preferred areola/nipple ratio in conjunction with the patient wishes. The primary goal in nipple reduction surgery is to preserve function and physical appearance with minimum scarring. A gold standard technique should spare neurovascular function, be easily reproduced and avoid destruction of the lactiferous ducts. In addition, this surgery should include reduction of height, width and base whenever suitable in macrothelia. Different techniques are applicable with regard to age, gender and individual concerns; however, further explicit clinical guidelines to achieve satisfactory results would be desirable.

In future publications concerning the surgical reduction of macrothelia, we suggest follow-up with clinical photographs and standardised assessment of patient-reported outcomes with regard to aesthetic results, scars, sensibility²⁷ and erectility,³ as well as rigorous description of post-operative complications.

Conflicts of interest statement

None to declare.

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