Use of ultrasound in identification of deep and superficial planes for lipografting in augmentation mammoplasty: Literature review

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ABSTRACT

OBJECTIVE: To identify deep and superficial breast planes by ultrasound for fat grafting in breast augmentation procedures. METHOD: Literature review of the PubMed electronic databases. The descriptors "breast fat grafting", "augmentation mammoplasty", and "ultrasound breast fat grafting" were used, including articles in English with no limitation of publication date. RESULTS: Ultrasound can be a tool that helps plastic surgeons to provide more natural results when it comes to mammoplasty surgeries. Fat is usually placed in the pectoralis major muscle, which provides volume and projection, but it is the placement of fat in the more superficial tissues that controls breast shaping. Small and large breast defects can be filled; bony prominences and visible edges of the implant may be disguised; radiation damage can be improved; reconstructions can be refined; difficult breasts can be shaped precisely; implants can be removed and replaced with fat; and a simple and natural increase can be realized. It is essential that fat be placed in very small aliquots to maximize surface area for revascularization and minimize the chance of fat necrosis. CONCLUSIONS: The use of ultrasound has been an innovative tool for fat grafting in body contouring techniques. In breast augmentation, it has a useful function in accurately visualizing the area to be grafted. Areas of fat grafting are not yet well defined, since fat injection is often done at all levels of the breast. Through the use of ultrasound associated with fat grafting of deep muscular planes and superficial planes in association with breast augmentation, small and large breast defects can be filled; Bony prominences and visible edges of the implant can be disguised.

Keywords: Breast fat grafting, Augmentation mammoplasty, Ultrasound breast fat grafting.

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INTRODUCTION

In the context of Plastic Surgery, a debate is fostered between the use of ultrasound technology as a planning tool and intraoperative use in body contouring and reconstructive surgeries.

The graft zone classification arose after recognizing a consistent pattern of contour and shape variations in patients with thin breast augmentation and was expanded to include the location of the autologous fat graft and its relationship to breast anatomy and the silicone implant.[15th]

Although the guidelines and technical principles are well known, fat grafting continues to be a "blind" method with unpredictable and sometimes inconsistent results for most surgeons. Its use seeks the symmetry of the patients and the achievement of natural results, taking into account the anatomy of each patient. [8]

Currently it is used as an important part of fat grafts (intramuscular), it also helps to locate the structures of each patient, in their correct place and with their own variations, which allow us to have personalized results respecting the individual characteristics of each patient.[8]

Fat transplantation is currently a widely used procedure in plastic and reconstructive surgery. Although the technical guidelines and principles are well known, it is still a "blind" method with unpredictable and sometimes inconsistent results.[8]

OBJECTIVE

Identify deep and superficial breast planes through ultrasound for fat grafting in breast augmentation procedures.

METHODS

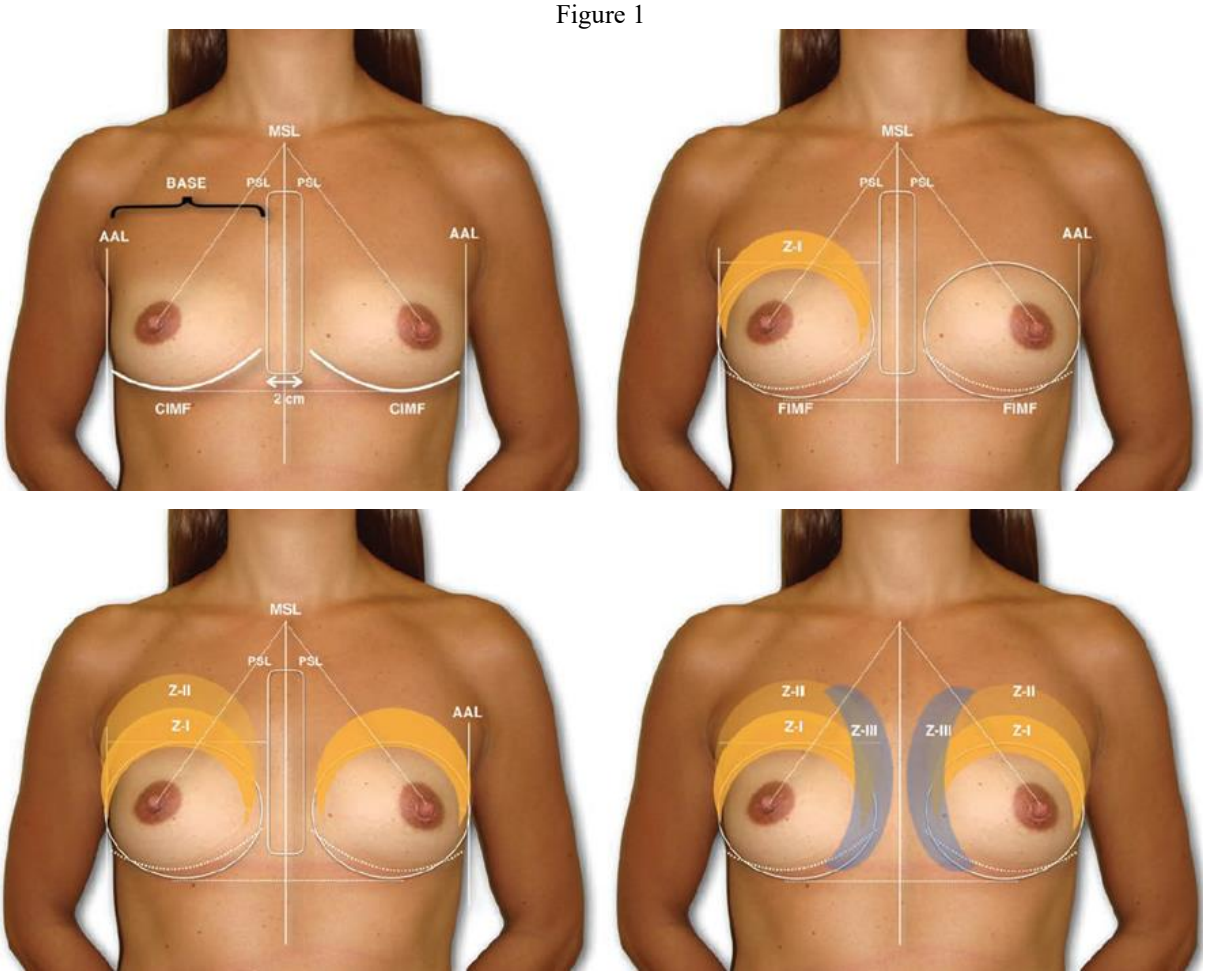
Literature review of 23 articles in the electronic databases PubMed, Medline and VHL. Six articles were excluded due to tangentiality of the study objective. The descriptors "breast fat grafting", "augmentation mammoplasty", and "ultrasound breast fat grafting" were used, including articles in English with no limitation of publication date.

RESULTS

In 2009, the ASPS Fat Grafting Task Force stated that "fat grafting may be considered for breast augmentation and correction of defects associated with medical conditions and previous breast surgeries."[4] According to Munhoz, Alexandre Mendonça, et al., fat grafting and the recognition of cleavage zones are important to obtain satisfactory results. This procedure offers a good alternative for mammoplasty candidates.[14] However, the results depend on the surgeon's technique and experience." [4] The most suitable ultrasound used is the one with a linear transducer operating at 7.5 MHz.[2]

Marks corresponding to the current inframammary fold, the anterior axillary line and the sternal midline (Figure 1) are traced, demonstrating preoperative markings in a 27-year-old patient with bilateral symmetrical hypomastia and a 1.0 cm clamping test. With a mean distance of 2 to 3 cm between the breasts and the areas of fat grafting in the upper pole and medial poles represented by zones I, II and III.] [15th]

Figure 1



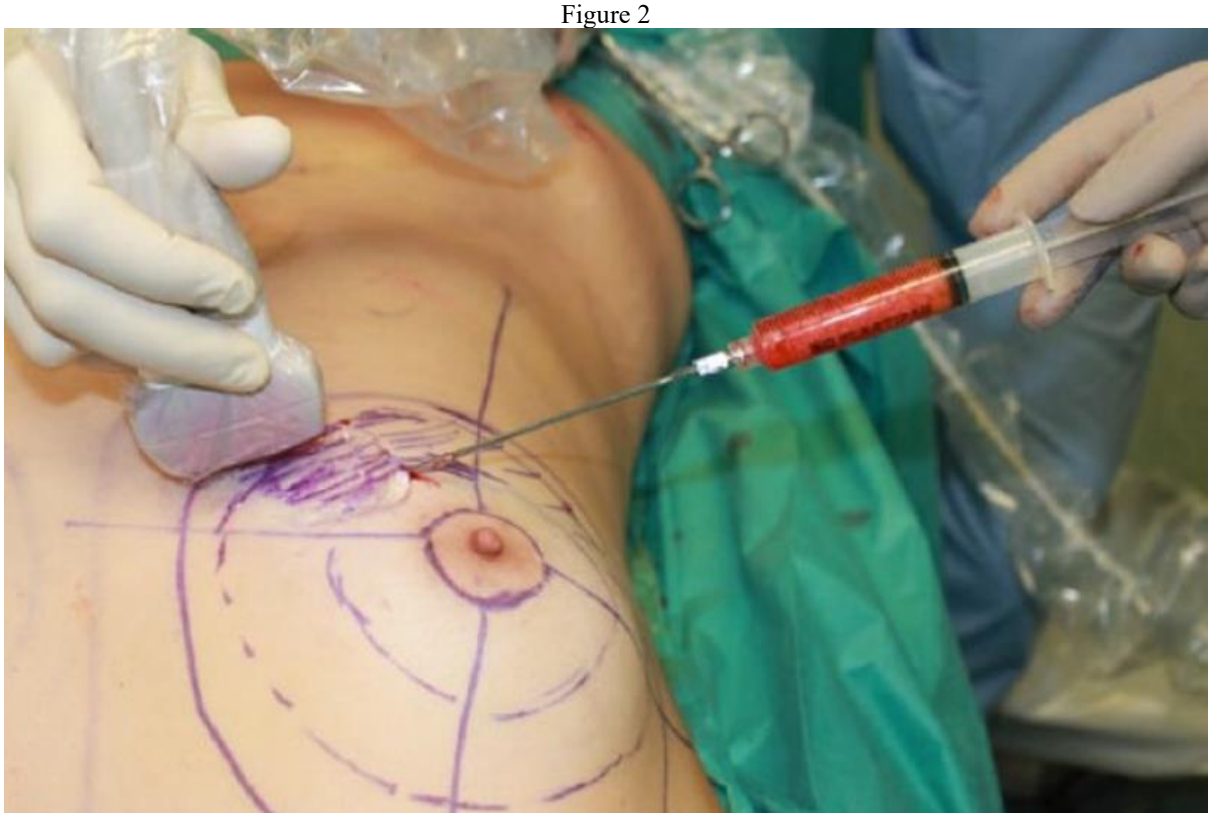
Skin tags include current symmetrical inframammary fold (FMIC), future inframammary fold (FIMF), lateral limit of the pouch, represented by the anterior axillary line (AAL), midline (MSL), and parasternal lines (PSL) [15]

The upper/lower limits of the pocket, represented by the future inframammary fold and upper breast line, respectively, are planned according to the volume of the implant, which allows for precise centering of the implant and maintains accurate pocket dimensions based on the size of the implant.[15th]

Ultrasound offers a portable, non-invasive means at the bedside to gain real-time visualization of the patient's anatomy, as well as providing an effective, focused, and safe power source for procedures. [19] Regarding the feasibility of ultrasound-assisted fat transplantation, issues of

asymmetry and issues of breast reconstruction (expander/prosthesis) where the reconstructed breast (with implant) is injected to improve symmetry are considered.[8]

Figure 2



For [8] Various levels of injection were created using fat grafting cannulas, to obtain the correct three-dimensional distribution in different planes from depth to surface and in a criss-cross pattern, avoiding the accumulation of large amounts of fat.

Of the advantages of ultrasound-guided breast fat grafting, better control of the infiltration plane (e.g., superficial, intermediate, and deep) can be assessed; less filled areas are clearly seen and additional fat can be transferred to fill them, thus increasing graft survival and integration of implanted adipose tissue at the recipient site. The three-dimensional dispersion of the fat at various levels from depth to surface is achieved through the creation of the mesh or crisscross pattern. [8]

In addition, it prevents or reduces the risk of inadvertent perforation in the case of previous implant placement, in the treatment of residual deformities after breast reconstruction, capsular contracture or when we intend to improve the volume and appearance of the breast (Figure 3). In the upper outer quadrant, fat grafting gives shape to the tail of the breast as well as increases the projection of the upper medial quadrant. In the lower quadrants, it adds thickness to the subcutaneous tissue, enhancing naturalness and creating a better defined inframammary fold.[8]

Figure 3

Infiltration cannula (black arrow); implant lumen (white arrow). [8]

For Herold *et all*., when injecting fat intramuscularly, the resistance is disproportionately greater, so one can certainly feel when injecting whether it is being injected intramuscularly or periglandular.[7] The comparison of the calculated volumes with the MRI volume in the pre- and postoperative periods revealed a mean volume persistence of 64% (± 13%) in the pectoralis muscle and 81% (± 8%) in the periglandular fat. [7]

In autologous fat transplantation to the breast, the periglandular plane is superior to the intramuscular plane in terms of volume persistence. [7] The conscious use of muscle tissue as a recipient matrix for fat grafts is based on research into the idea that the survival of injected fat grafts before they find a vascular connection is based on pure diffusion. It can be shown that the maximum plasma diffusion distance is 100γm8. The dense vascularization of muscle tissue could therefore make it the preferred matrix for adipose tissue transplants. [7]

In the breast/breast region, fat grafting has been used in the following clinical presentations4:

1. Reconstructing a breast after mastectomy.
2. For correction of tuberous breasts (the constricted lower pole of the tuberous breast may be preferentially expanded to improve the overall shape) and Poland syndrome (absent or atrophic pectoral muscle and the breast in Poland syndrome may be simulated using fat).
3. To reverse the damage caused by radiation after breast cancer treatment.
4. To replace implants that have been removed.

5. Asymmetries
6. Primary breast augmentation in intramuscular and/or periglandular patients. Graft placement around breast implants targeting the edges and improving capsular contractures. In addition, wrinkles and dimples can also be disguised with the addition of fat around the implants.

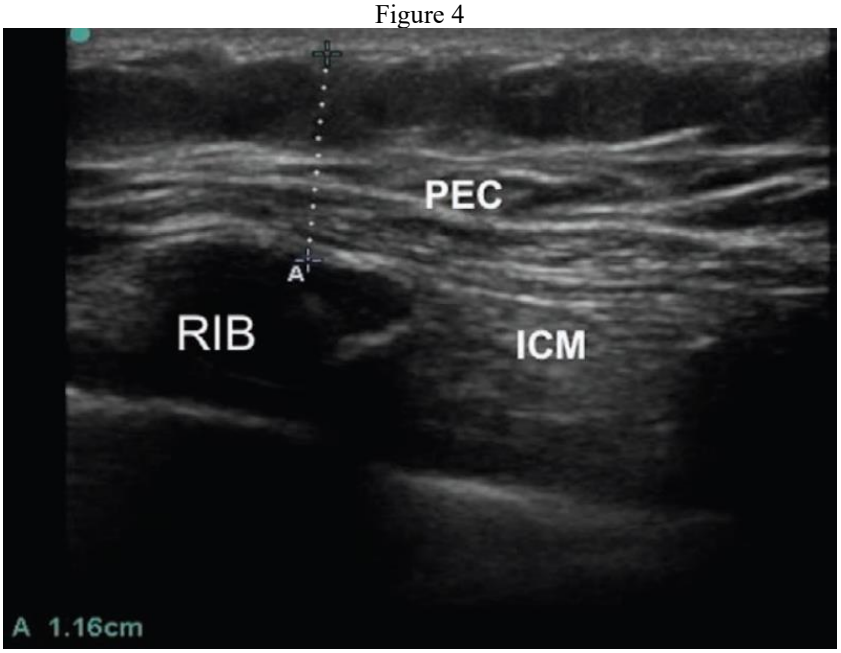
For correction of tuberous breasts and Poland syndrome, which is the absence or hypoplasia of the breast or nipple, hypoplasia of the subcutaneous tissue, absence of the costosternal part of the pectoralis major muscle, or absence of the pectoralis minor muscle, the constricted lower pole of the tuberous breast can be preferentially expanded to improve the overall shape, and the absent or atrophic pectoralis muscle and breast in Poland syndrome can be simulated using fat. [4]

The pectoral muscles offer additional recipient tissue for fat transplantation and may be especially needed in smaller breasts to achieve the desired volume increase.[7] "Fat is usually placed in the pectoralis major muscle, which provides volume and projection, but it is the placement of fat in the more superficial tissues that controls breast shaping." [4]

For patients mastectomized after radiotherapy, it can be a challenging group of patients for reconstruction. Radiation therapy leads to scarring of tissues, and fat grafting can help improve the overall appearance, feel, and thickness of mastectomy skin flaps before definitive reconstruction. Figure 4 demonstrates how ultrasound can be used to visualize not only the pectoralis major muscle, but also the underlying ribs and lung/pleura. This allows the surgeon to place the fat grafts precisely on the pectoralis major muscle, preventing a possible perforation of the lung. [16]

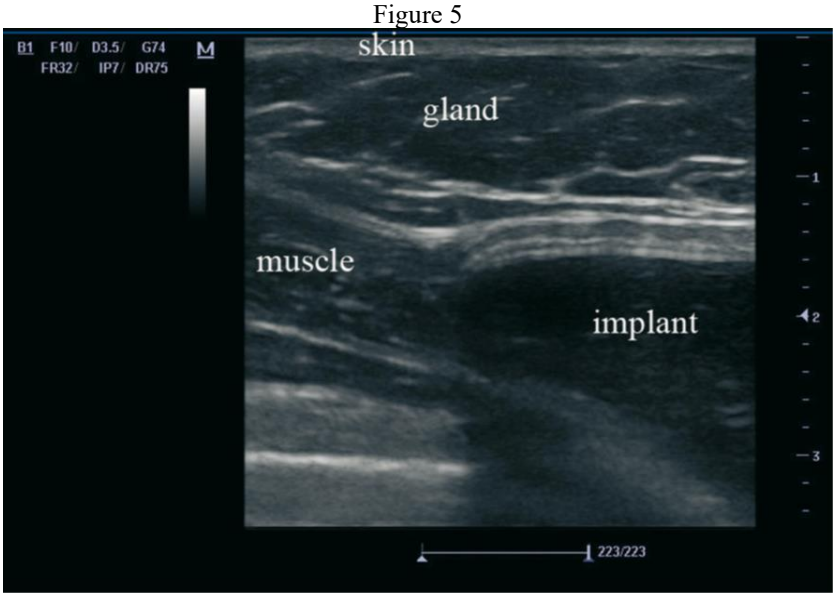
Ultrasound can help visualize the pectoralis major muscle, ribs, and intercostal spaces to ensure that fat is deposited in the pectoralis muscle and subcutaneous space without damage to the underlying lung.[16]

Figure 4



Fat grafting in a lean patient submitted to mastectomized skin flaps. The ultrasound machine can be used to identify the pectoralis major muscle (PEC), ribs, and intercostal muscles (ICM). It can also be used to measure the thickness of subcutaneous tissue (number in the lower left corner). [16]

Figure 5



Ultrasound of the breast showing the normal view of the different layers: skin, gland, pectoralis muscle and implant. The implant appears as a hypoechoic (black) mass surrounded by hyperechogenic lines (capsule).[2]

Figure 6

Intracapsular rupture of an implant. There is silicone outside the casing (S), and echogenic lines from the broken capsule are seen floating inside the silicone, an ultrasonographic correlate to the magnetic one. [2]

For MAXIMILIANO et all. 2019, above the upper limit marked at the end of the implant, an upper detachment of 2-3 cm is added for better accommodation of the implant in the pocket, and then a new mark of 3-5 cm is made in its longest length, the area in which the fat graft will be performed with the intention of giving a greater height to "the implant", Transforming it into an anatomical shape, in addition to better coverage in the medial portion of the breast to reduce intermammary distance *and the risk of rippling*, in a crescent shape the lowest point starts at the anterior axillary line and ends at the papilla line on the side of the ipsilateral sternum bone. [9]

Another retrospective study in 305 female patients who underwent augmentation mammoplasty with EVE-assisted fat grafting between September 2012 and December 2020. [6] Of these patients, they were aged between 18 and 50 years (mean of 35.9 years). Among them, 68.52% were "very satisfied," 18.69% were "somewhat satisfied," 11.15% were "somewhat dissatisfied," and 1.64% were "very dissatisfied" based on the BREAST-Q analysis, while 100% were dissatisfied according to the Preoperative Breast Satisfaction Questionnaire. [6] The results showed that 76.01% had an increase in breast volume from 150 to 250 mL or >250 mL and were "satisfied" and "very satisfied", respectively, 21.64% had an increase from 50 to 149 mL and were "somewhat satisfied", and 2.30% had an increase <50 mL and were "dissatisfied". There were no complications. [6]

DISCUSSION

The patient's clinic can guide the surgeon regarding the investigation of the superficial planes of the breast, taking into account the anatomy of each patient. Well-defined areas of the planes can avoid complications such as perforation of the lung and/or prosthesis. Thus, ultrasound offers a portable, non-invasive means at the bedside to achieve real-time visualization of the patient's anatomy, as well as providing an effective, focused, and safe power source for procedures.

Fat grafting is a simple, fast, low-complication and effective treatment method and, therefore, an important therapeutic complement for breast malformations and deformities. In addition to obtaining a more beautiful contour and greater volume, you also notice an improvement in the quality of the scar.

Fat grafting and recognition of cleavage zones are still important to obtain satisfactory results. This procedure offers a good alternative for candidates for breast augmentation, providing a smooth surface suitable for stabilization also when the implant is present.

Despite a consensus on standardization, superficial and deep breast planes are still poorly described for grafting when assisted by ultrasound. Thus, the description of the identification of ultrasound-guided anatomical structures for preoperative surgical planning is still vague, and there is a lack of evaluation of the degree of satisfaction. In addition, the results depend on the technique and experience of the surgeon.

CONCLUSION

The use of ultrasound has been an innovative tool for fat grafting in body contouring techniques. In augmentation mammoplasty, it has a useful function in accurately visualizing the area to be grafted, but there is still a lack of studies in the description of anatomical accidents in surgical planning. Areas of fat grafting are not yet well defined, since fat injection is often done at all levels of the breast. Through the use of ultrasound, fat grafting of deep muscular planes and superficial planes in breast augmentation procedures, small and large breast defects can be filled; Bone prominences and visible edges of the implant can be disguised and complications such as lung and prosthesis perforation can be avoided. More studies are needed to assess the levels of patient satisfaction with these procedures.

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