



Bra Cup Size and Breast Anthropometry for Assessing Breast Volume in Autoaugmentation Mastopexy by Inferior Dermo-Glanduar Flap for Moderate Size Ptotic Breast

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Gamalat Azmy Abdel-Salam Mohamed^{1*}, Dina Mostafa Badawi²

Abstract

Introduction: Aesthetic breast surgery became mandatory procedure almost all-over the world. Of these procedures augmentation mastopexy. The aesthetic goals are to reduce ptosis, improve volume and projection. Different techniques for combining mastopexy with augmentation in the same procedure became achievable using own breast tissue that acts as a natural implant. measuring breast volume is a tool for assessing the effectiveness of autoaugmentation and for choosing the best procedure for each patient. **Objectives:** the aim of the study is to evaluate the effectiveness of inferiorly-based dermo-glandular flap in autoaugmentation mastopexy for patients with moderate size ptotic breasts through measuring the change in breast volume using both bra cup size and breast anthropometry. **Patient and Methods:** the study was carried out on 23 healthy women with moderate size ptotic breasts age ranged from 25 to 55 years Between January 2016 and December 2018 in plastic surgery unit, kasr Al Aini hospital. Bra cup size as well as breast anthropometric measures (N-IMF, N-SN, IMD) were taken for all patients pre-operatively as well as 3,6,12 months post operatively. **Results:** the study shows that bra size changed from $38.35 \pm 2.81SD$ preoperatively to $39.61 \pm 2.82 SD$ 1-year post-operative with a significant p value 0.0001 with a mean increase in cup size $1.64 \pm 1.76 SD$ post-operatives with significant p value of 0.001. as well as change in the mean N-IMF distance from $13.44 \pm 1.21SD$, $12.28 \pm 1.43SD$ to $11.83 \pm 0.96 SD$, $10.97 \pm 0.96SD$ after 1 year for right and left sides respectively with significant p value. And the IMD changed from $20.78 \pm 1.40 SD$ preoperatively to $20.32 \pm 1.52 SD$ at 1 year with significant p value. Also, significant decrease in (N-SN) distance with mean preoperative of $32.21 \pm 2.99 SD$, $32.68 \pm 3.33SD$ to $23.87 \pm 2.21 SD$, $23.26 \pm 3.16SD$ 1year post-operative for right and left breast respectively with significant p value. **Conclusion:** using breast volume as assessment tool after inferior dermoglandular flap auto-augmentation mastopexy through measuring the bra cup size and breast anthropometry is a simple and easy non costing tool for judging the effectiveness of the procedure.

Key Words: Bra Cup Size, Breast Anthropometry, Autoaugmentation Mastopexy, Inferior Dermo-Glanduar Flap, Ptotic Breast

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Corresponding author: Gamalat Azmy Abdel-Salam Mohamed

Email: gamalat.azmy@yahoo.com

Affiliations:

1-M.B.B.Ch., M.Sc., M.D., Plastic Surgery, Faculty of Medicine, Cairo University, Egypt.

2-M.D., plastic surgery, Assistant professor of plastic surgery and reconstructive surgery, Faculty of Medicine, Cairo University, Egypt.

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Introduction

The auto-augmentation mastopexy using an inferior pedicle dermo-glandular flap aims to increase the fullness in the upper pole and enhances the central projection of the breast with increasing breast volume through redistributing the breast tissue in women who want to augment their breast without use of implants. (1)

The Determining factors for breast shape and aesthetics are volume, parenchyma distribution, tissue elasticity, location and appearance of the NAC, quality of the skin envelope, and the relation between the final shape of the breast, thoracic wall, and the body (2).

Several methods of assessing breast aesthetics are ranging from subjective visual assessment by human observers, stereophotogrammetry (3) and 3D digital photography (4) and objective anthropometric measures including the body weight, height, shoulder and chest dimensions along with the entire measurements of the breast with a surrounding fixed landmark. (5,6)

Breast volume is a major concern of women requesting breast reshaping. Mastopexy autoaugmentation is a suitable technique for moderate-sized ptotic breasts in women who regret the use of implant. Mastopexy with augmentation of the breast by recruitment of the inferior glandular-fatty tissue enhance the breast volume in the upper pole and keep the size of the breast. In this study, we used a simple method to assess the breast volume change after mastopexy autoaugmentation using the bra cup size changes along with breast anthropometric measures.

Patients and Methods:

Between January 2016 and December 2018, a prospective non randomized clinical study was performed on 23 healthy women with an age ranged from 25 to 55 years (average). All women had moderate size breast along with moderate ptosis (according to Regnault classification system). They requested lifting and augmentation of their breast without the use of mammary implant or fat grafting. They have had mastopexy autoaugmentation in the plastic surgery unit, Kasr Al Aini hospital. Women having previous breast surgery, lactating, history of breast lumps, psychologically unstable, and those with skin problems and/ or uncontrolled medical conditions were excluded from the study. The parameters are entered into sample

size calculation software (*StatsToDo*), the sample size was 19 participants. However, with 15 % drop rate, the sample size was 23 participants. The alpha value was set at $p < 0.05$.

Pre-Operative assessment

Preoperative assessment of weight, height and BMI, level of education, marital status, history of menstrual cycle, contraception, weight loss history through diet or bariatric surgery and history of lactation was taken in consideration. Routine pre-operative laboratory investigations were done to all patients. Preoperative radiological investigations included mammographic studies done for patients above 35 years and ultrasonic studies for patients below 35 years. Preoperative marking while the patient in the standing position including measurement of the distances between the nipple and the Suprasternal notch (N-SN), between the nipple and the infra-mammary fold (N-IMF), and the inter-mammary distance (IMD). also, pre-operative measurement of bra cup size including the under band, over bust and back size were taken. All the measurements were performed with the woman standing in a relaxed vertical position with empty lungs (after exhalation). Two measurements are made around the thorax for both the tape should be firm but not tight. The first measurement is circumferentially under the breasts at the level of the infra-mammary fold (the under band). The second measurement is around the back and breasts at their most prominent point (the over bust). (**Figure 1**). The inferior dermo-glandular flap designed with a width of 6 to 8 cm, and a length 1-2 cm below the NAC. Preoperative photos and a written informed consent obtained from all patients.

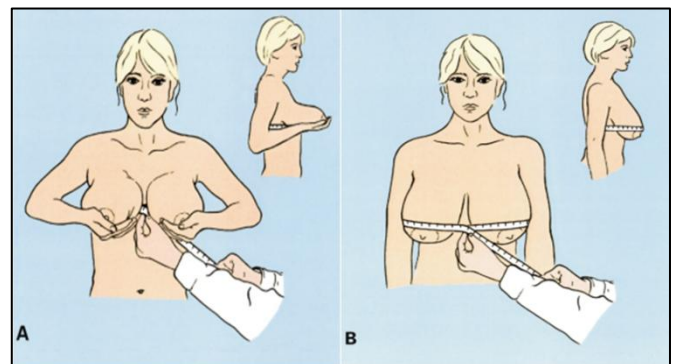


Figure (1): Bra measurement (A) Underband and (B) overbust measurement (Greenbaum A.R. 2003).

Operative principles

Under general anesthesia with the patient in supine position de-epithelialization of the peri-areolar and pedicle were done. **(Figure 2)**. The superior pedicle carrying the NAC is separated from the inferior triangular dermo-glandular flap and undermined till the level of the second d rib to create a pocket beneath it. **(Figure 3)**. The inferior de-epithelialized flap dissected from its medial, lateral margins deep to the pectoralis fascia. The dermis is completely incised at its lower margin. The flap is not dissected deeply from the pectoralis fascia to preserve the integrity of its blood supply. **(Figure 4)**. The inferior de-epithelialized flap folded underneath the superior pedicle carrying the NAC and fixed to the pectoralis major fascia at the level of the second rib with 3-4 polypropylene sutures to maximize the upper pole volume and projection **(Figures 5,6)**. Then Closure of the peri-areolar incision performed via a round block technique using a purse-string suture. And finally, the vertical limb sutured in layers.

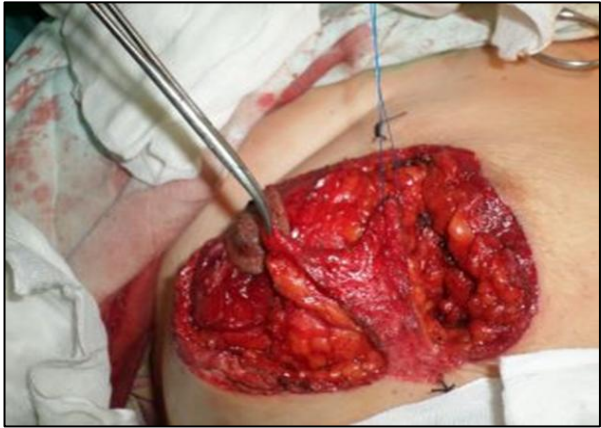


Figure (4): The inferior deepithelialized flap dissected from its medial, lateral margins deep to the pectoralis fascia

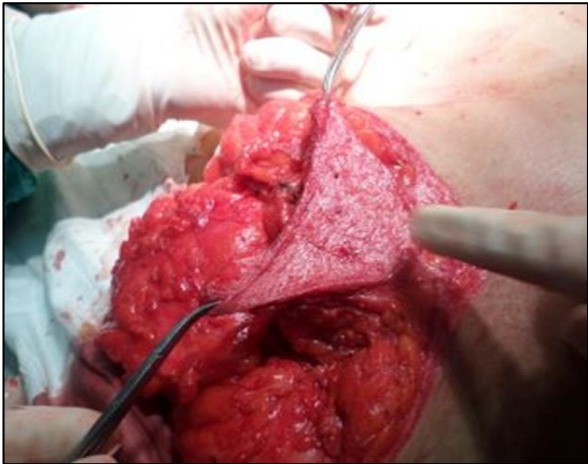


Figure (5): The inferior deepithelialized flap folded underneath the superior pedicle



Figure (2): deepithelialization of the peri-areolar and inferior dermoglandular flap area.



Figure (3): The superior pedicle carrying the NAC is separated from the lower triangular flap



Figure (6): The inferior flap fixed to the pectoralis major fascia at the level of the second rib with 3-4 polypropylene sutures

Post-operative assessment tools

Follow up period will be at 3, 6 months and 1 year respectively judged by post-operative photos, Anthropometric measures include nipple- supra



sternal notch (N-SN), nipple-infra-mammary fold (N-IMF), and the inter-mammary distance (IMD), bra size and cup size measurements.

Statistical methods

Sample size calculation was done using (*StatsToDo software*) with alpha value set at $p < 0.05$ and power (β) of 90%. T test was used to calculate mean and standard deviation (SD), Median, minimum and maximum IQR were calculated. Scatterplot statistical method calculating the Pearson's correlation coefficient (r) to correlate anthropometric measures with risk factors and r value was classified as very weak, weak, moderate, strong, very strong. Data was verified by Wilcoxon signed ranks test using the Statistical Package of Social Science (SPSS) analysis software. The level of significance was set at P value < 0.05

Results

In the study population (23cases), the age was between 25-55 years with mean value 36.96 ± 6.24 SD. the BMI was between 24.4- 32.8 with mean value 26.46 ± 4.30 SD. Minimum age for first cycle was 13 and maximum age was 15 with median value of 14 and IQR of 2. As regard the marital status 3 (13%) were single, 19 (82.6) were married and 1(4.4) was widow. As regard the number of children, the range was between 0-5 with median value of 2 and IQR of 2.5.as regard previous history of lactation 20 (87.0%) has a previous history of lactation while, 3 (13.0%) were not. 22 (95.7%) were menstruating with 14 (60.9%) have regular menses and 9 (39.1%) have irregular menses, 1 (4.3%) was post-menopausal.18(78.3%) of people used contraception while 5 (21.7%) did not use. 12 (52.2%) had family history of ptosis, while 11 (47.8%) had no history (**Figure7**)

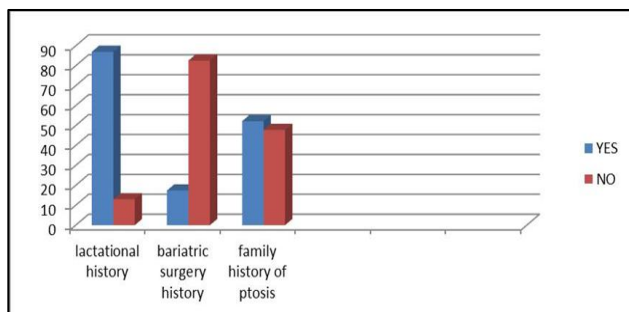


Figure (7): Prevalence of risk factors for breast ptosis among study population

By correlating the anthropometric results of (N-SN), (N-IMF), and bra size, cup size preoperative, with the risk factors like BMI, no of children. found significant correlation between age and BMI. also, a significant correlation was found between age and N-SN measurement as well as a significant correlation between N-SN and N-IMF. Also, a significant correlation was found between N-IMF and cup size as well as between cup size and bra size. (**Table 1**)

Table (1): Correlation between BMI, no of children, bra size, cup size, (N-SN), and (N-IMF) preoperative

	BMI	No. of children	Age	Bra size	Cup size	N-SN-Rt	N-SN-Lt	N-IMF
BMI								
No. of children	r=0.35 P=0.09							
Age	r=0.44 P=0.04	r=0.37 P=0.08						
Bra size	r=-0.09 P=0.68	r=0.36 P=0.097	r=0.14 P=0.52					
Cup size	r=-0.12 P=0.58	r=-0.30 P=0.16	r=-0.09 P=0.97	r=-0.44 P=0.04				
N-SN-RT	r=0.08 P=0.73	r=0.09 P=0.68	r=0.50 P=0.02	r=-0.03 P=0.88	r=0.32 P=0.13			
N-SN-Lt	r=0.05 P=0.82	r=0.07 P=0.76	r=0.48 P=0.02	r=-0.02 P=0.93	r=0.31 P=0.15	r=0.99 P=0.000		
N-IMF	r=-0.12 P=0.58	r=-0.01 P=0.96	r=0.36 P=0.09	r=0.04 P=0.87	r=0.44 P=0.03	r=0.79 P=0.000	r=0.80 P=0.000	

As regard anthropometric measurements, there was significant decrease in right breast (N-SN) distance with mean preoperative of 32.21 ± 2.99 SD to 23.87 ± 2.21 SD 1-year post-operative with significant p value < 0.0015. The left breast (N-SN) distance with mean preoperative of 32.68 ± 3.33 SD, and at 1 year was 23.26 ± 3.16 SD with highly significant p value 0.004.

As regard N-IMF the Mean preoperative value was 13.44 ± 1.21 SD for the right side, became at 1 year 11.83 ± 0.96 SD with significant p value 0.000 and for the left N-IMF the preoperative value was 12.28 ± 1.43 SD, became 10.97 ± 0.96 SD at 1 year with significant p value 0.000.

As regards IMD it was 20.78 ± 1.40 SD preoperative, became 20.32 ± 1.52 SD at 1 year with significant p value 0.002.

Of the 23-study population there was 13 (56.6%) increase in bra size by 2 degrees, 3 patients (13.05%) there was increase in bra size by 1 degree, and no change in 7 (30.4%). With 38.35 ± 2.81 SD preoperative value changed to 39.61 ± 2.82 SD 1-year post-operative with highly significant p value 0.0001. (**Figure 8**)



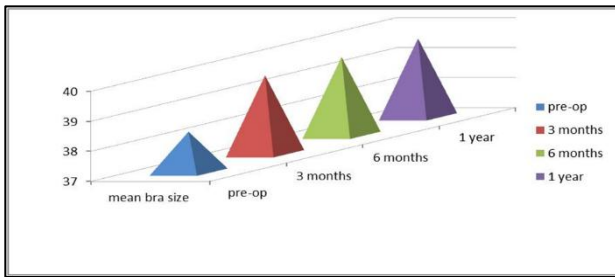


Figure (8): Chart show the change in mean bra size pre-operative and 3,6 months, 1 year post operative

As regard change in cup size 4 (17.3%) were increase by 2 degrees. 10 (43.4 %) increase by 1 degree. There was 7(30.4%) of population with no considerable change in cup size and 2 (8.6%) patients decrease in cup size by 1 degree. So, there was a significant change in mean cup size as 60.8% (14) of population there was increase in cup size from pre-operative to post-operative. As a conclusion there was a mean increase in cup size 1.64 ± 1.76 SD post-operatives with significant p value of 0.001. **(Figure 9)**

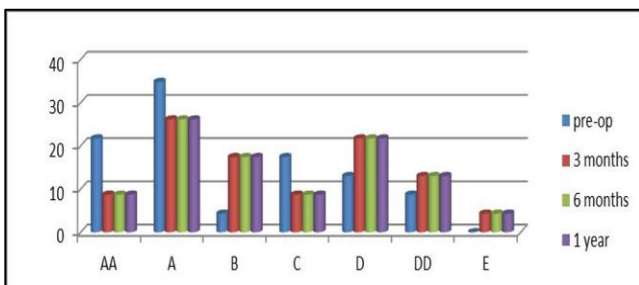


Figure (9): Chart show the percentage of different cup sizes preoperative and 3, 6 months, 1 year post operative

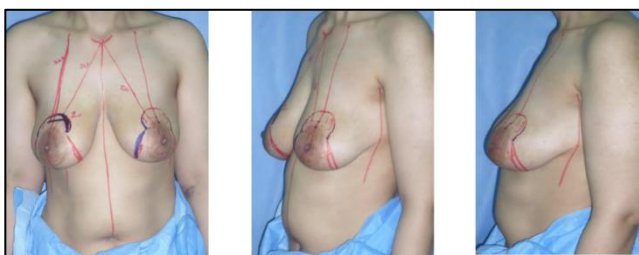


Figure (10): 32 years old patient preoperative front, oblique and lateral views

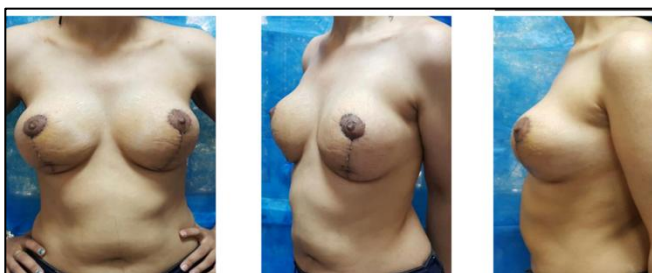


Figure (11): 32 years old patient 3months post-operative front, oblique and lateral views

Discussion

In cosmetic breast surgery measuring tools is very important to assess the post-operative results. Unfortunately, one dimensional measurement is not sufficient for assessing breast volume. it is a tool to assess breast ptosis. Also, 3 dimensional technologies need a special chest wall template, assign landmarks, difficult imaging under breast and a highly advanced software system that is both expensive and not easily available. Also, relying on the photographs to judge results is impractical for causes related to focal distance adjustment, the same poses and the same arm position in addition to chest position. Other techniques used like, water or air displacement, plaster molds, adjustable measuring cones, mammograms and Stereo photography are all difficult and operator dependent (7)

In a Chinese prospective study of breast anthropomorphic measurements, volume and ptosis in 605 Asian patients with breast cancer and benign breast disease from July 2014 to October 2014 reveled a positive correlation between breast volume measured by the modified formula of BREAST-V and cup size with significant P Value $P < 0.001$. (8)

Two factors are determining the bra cup measurements in a non-complex way, the band size which is the chest circumference under the breast and the bust size which is at the maximal breast projection. Many factors control the postoperative bra cup size like patient preference, height, hips, bust and pedicle design and thickness according to surgical technique. It was found that reduction techniques affect the bust not band size that affect the cup size. These methods of predicting breast reduction sample and hence predicting bra cup size post-operatively mostly relied on metric measurements of the female breast and the traditional brassiere measuring. (9)

However, most women don't know exactly the best fitted bra size and due to different brands of bra manufacturers especially for those with ptotic breasts they prefer to wear loose bra with large cup size and after mastopexy they experience decrease in cup size, so it is important to take accurate measurements of bra cup size in the suitable position and suitable poses in the pre-operative setting. Many authors noted that the change in skin envelope alone through mastopexy only without disturbing breast parenchyma would not result in change in bra cup size. In a study of 20 patients underwent mastopexy only without augmentation,

a decrease by 1 cup size was noted without change in band size as no parenchymal redistribution done with confirming the same brassiere manufacturer and although one patient gained weight but still lost 1 cup size with mean follow up period 4.9 years. (10)

An Australian cross sectional questionnaire-based study to explore the effects of increasing breast size on mature-aged women using the breast size score (BSS) as well as the BREAST-Q, numerical rating scale (NRS) and adjusted activity score (AAS) .from 269 participants. The study showed that an increase in breast size, equivalent to a one-cup size increase on the same band, or one-band size increase at the same cup size. (11). A study done by Brown N 2012 to identify predictors of breast mass through measuring anthropometric measures in smaller and larger breasts. Breast mass determined by bra fitters by under-band and cup size of 93 women from A to H sizes. Found that larger bra sizes associated with large breast mass. A strong linear correlation between suprasternal notch to nipple distance and the amount of tissue excised in breast reduction was declared. (12)

a comparative study done by **King NM and colleagues 2017** to assess the standard volume to increase cup size after breast augmentation through 3 methods used in the study linear measurements, volume measurement by water displacement; and volume calculation after three-dimensional reconstruction of serial radiographic data (computed tomography) done on 79 patients underwent breast augmentation from 2014 to 2016. revealed that that 130 to 150 cc equal to a one-cup-size increase whilst Bras with narrower band widths need 130 cc and wider band widths require 150 cc to increase one cup size. (13). Also, in 2008 **Karabulut** used a nomogram to reveal that every 100-cc increase in breast volume through implant there was increase in bust circumference of 2 cm. but it was difficult for the patient to visualize the difference post operatively. (14). The process of predicting cup size before cosmetic breast surgery either reduction or augmentation is a matter of debate. In 1984 **Regnault and Daniel** (15) advocated a formula for predicting bra cup size after reduction mammoplasty which was later revised by **Turner and Dujon 2005** (16) (table 2,3). However, A study done by **Chan M, 2019** to predict the size of resection specimens of reduction mammoplasty using a special formula

to measure breast volume and hence detect the proper cup size expected post-operatively. The results show that the band size affects the breast volume for a given cup size that support the hypothesis that similar cup volumes obtained by decreasing band size. So, bra cup size of 14B is similar breast volume to 12C. (17)

Table (2): Regnault and Daniel formula for estimating breast size and resection weight (method A) (15)

Table 1 Regnault and Daniel Formula for estimation of breast size and resection weights (Method A)	
Estimation of breast size	Weight of tissue to be removed
A = Breast > chest by 1 in.	32-34 in. 100 g per cup size required
B = Breast > chest by 2 in.	36-38 in. 200 g per cup size required
C = Breast > chest by 3 in.	40-42 in. 300 g per cup size required
D = Breast > chest by 4 in.	44-46 in. 400 g per cup size required
Etc.	

Table (3): revised formula for estimation of breast size and resection weight (method C).(16)

Table 3 Revised formula for estimation of breast size and resection weights (Method C)	
Estimation of breast size	Weight of tissue to be removed
A = Breast = chest girth	32-34 in. 115 g per cup size required
B = Breast > chest by 1 in.	36-38 in. 215 g per cup size required
C = Breast > chest by 2 in.	40-42 in. 315 g per cup size required
D = Breast > chest by 3 in.	44-46 in. 415 g per cup size required
Etc.	

In 2005 **Widgeon** advocates the inferior dermo-glandular flap as auto-augmentation flap as it provides good vascularization of the lower portion of the breast as it is based on the fourth, fifth, and sixth intercostal perforating vessels of the internal mammary vessel. In addition to the conization effect gained by the versatile inferior dermo-glandular flap which augments the superior pole improving the apparent ptosis and enhancing breast projection. (18). Also, a study done by **Swanson E, 2013** revealed that the vertical method is a novel method in enhancing both breast shape and upper pole projection. In vertical reduction mammoplasty combined with mastopexy that using the inferior pedicle as it is safe to remove lower breast tissue and effectively elevates the breast mound and lower pole and apparently enhancing breast volume. (19)



A retrospective case series study of 24 cases for cosmetic and 5 cases for reconstructive purposes were included wanted to remove their implants and underwent autoaugmentation. A superior, superomedial, and inferior pedicles were used with or without fat grafting divided in 3 groups. In all cases preoperative measurement of bra size was taken into consideration to standardize the measurement of the final breast volume with breast Q to assure patient satisfaction. (20)

A case report documented by **Umar Daraz Khan**, 2015 showed a case of explantation 450 cc breast implant 5 years after augmentation for neck and backache with the patient was 34 E cup size prior to explantation using the inferior dermoglandular flap for autoaugmentation without insertion of implant or fat graft .the result was satisfactory to both patient and surgeon with nice augmented non ptosed breast and bra cup size 34C which was satisfactory to the patient conserving the bra size and reducing the cup size slightly from E to C. (21)

A retrospective review study done by **Raffi Gurnluoglu and Bulent Sacak** in Turkey Istanbul, 2013 on 20 patients aged 38-66 treated by reoriented inferior dermoglandular flap for autoaugmentation after explantation of breast implants for problems of capsular contractures, implant rupture, hematoma or silicone bleed or even asymmetry between 2007 and 2011. Preoperative and postoperative bra size were documented for each patient along with breast Q after determining the implant type, size and location. Results were that 68.5% of implant volume was restored through reoriented inferior dermo-glandular flap with one-cup reduction in bra size in 17 patients, and the cup size remained the same in 3 patients. (22)

In our study, we used the same bra manufacturer company and also, we guided our study by breast anthropometric measurements like nipple – sternal notch (N-SN) and nipple – infra mammary fold (N-IMF) and inter mammary distance (IMD). Also, we used the simple formula of Greenbaum A.R, 2003 to measure cup size through band and bust sizes then we obtained back size and by comparing this back size to bust size we can define cup size in a simple way. (23)

We choose the inferior dermoglandular flap as there is available breast tissue in the lower pole of the breast which enable using it as autologous implant fixed to the pectoral fascia by non-absorbable sutures which enhances breast

projection as well as augment the upper pole. Adding to the advantageous vascularity of the inferior dermoglandular flap and the ability to reorient the flap to the desired position as it is not including the NAC which attach to the superior pedicle.

By comparing the pre-operative bra cup size for all patients with the post operative bra cup size guided by the documented pre and post operative photos and anthropometric breast measurements. There was a significant change in breast shape and size with change in bra cup size between 1 to 2 cup sizes or no change in 2 patient and decrease in 1 patient.

So, relying on bra size change in auto-augmentation mastopexy by inferior dermoglandular flap may reflect the change in breast size and represent a simple method to assess the efficacy of auto-augmentation mastopexy, however, further studies with large sample size is mandatory to assure the results.

Conclusion

The inferior based dermo-glandular flap solved a lot of issues regarding ptosed atrophied breast and it was a solution for augmenting breast upper pole emptiness as well as breast projection with safety blood supply and preserved NAC vascularity and sensation. The question was does it affect the bra cup size or breast measurements? In this study it was concluded that the auto-augmentation technique using the inferior dermo-glandular flap causes a change in bra cup size as well as anthropometric breast measurements This may be regarded to the increase in breast projection with change in breast conus that is reflected on the bust measurement and it depends on other several factors including the chest size and shape, breast morphology and the BMI of the patient. Also, the different bra manufacturers also affect the precision of measurements. So further studies are needed to confirm the changes in bra measurements in different breast surgeries

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