Original Article

Application of "CD−4" Theory for Determining the Width of Implant in Breast Augmentation

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Abstract

Background: The determination of the width of the implant is the first key step to select shape and volume of the implant in breast augmentation. The aim of this study was to introduce a new method to determine the width of the implant (W) and explain the reasons to do so in details.

Methods: From January 2006 to June 2014, the authors have found and applied "CD−4" theory to determine the width of breast implant (W) in dual plane I or II breast augmentation cases through transaxillary or periareolar incision for 560 patients. "CD" is defined as the curved distance on skin from the midline of the sternal bone to the anterior axillary line (AAL) on the lateral chest wall through the horizontal level on inferior mammary fold. W = CD − 4 (or 3.5) cm.

Results: The 560 patients used both round and anatomic implants with W from 10.5 cm to 12.5 cm. Their CDs are from 14.5 cm to 17 cm. About 78% of the patients have got followed up from 1 month to 5 years postoperatively. Except for four patients who got unilateral capsular contractions, all the other patients are satisfied with their nature new breast shapes and volumes. Their new intermammary cleavages without bras are between 1 cm and 2.5 cm, and lateral borders of the breast are on the area of the AAL.

Conclusions: W (width of the implant) = CD − 4 (cm) when doing dual plan I or II breast augmentation. For the very thin patient, 4 should be 3.5.

Key words: Anterior Axillary Line; Breast Implant; Middle Line of Sternal Bone; Width

Introduction

For patients who need to do breast augmentation, there is an appropriate proportion between the breast implant width and the patients' thoracic width. The best implant width can produce not only the best intermammary cleavage, but also a suitable fullness on the lateral side of the breast. On the middle part of the sternal bone, the 3 cm wide "no touch zone"(NTZ) should be highly respected.[1,2] Dr. John B. Tebbetts emphasized that the medium dissecting edge of the implant pocket should stop at the point 1.5 cm away from the midline of the sternal bone to avoid damaging the vessel perforators. This means the most medium edge of the implant should not exceed the point that is 1.5 cm away from the middle line of the sternal bone. According to the normal breast anatomy,[3] most plastic surgeons choose the anterior axillary line (AAL) as the most lateral margin of the newbreast.[4,5] The above medium and lateral margins are the fundamentals of the following "CD − 4" theory.

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Methods

From January 2006 to June 2014, we had used "CD − 4"theory to choose the width of implants for 560 patients who got the dual plane I or II breast augmentation[6] through transaxillary or periareolar incision. We should take notice that the theory is not suitable for subfascia or subglandular breast augmentation.

"CD" is defined as the horizontal curved distance at the level of inferior mammary fold (IMF) from the middle line of sternal bone to the laterally AAL. It should be measured with a tape ruler adhering to the skin [Figure 1].

Where is the AAL? The AAL is defined as the perpendicular line on the lateral chest wall from the anterior point of the axillary fold.[7] The doctor should stand on the patient's lateral side to draw the line while considering the vertical direction of the thoracic wall [Figure 2].

The reason for measuring the curved skin distance with a tape ruler rather than a straight line with caliper is that the thoracic wall is curved, and the implant lies just on the curved ribs.

The reason for measuring CD on the level of IMF is that on this level, there is no influence of the breast tissue volume.

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Although for those very small breasts, the IMF is not so obvious.

W (width of implant) = CD − 4 (cm) is suitable for the regular patients. If the patient is so thin that we could see the contour of her ribs on the chest wall, W = CD − 3.5 (cm). If the patient has a certain amount of breast tissue, for example, the pinch test ≥2.5 cm, we could subtract 0.5 cm or 1 cm from W according to the patient's desire.

Postoperatively, we measured the distances between the two medium margins of the patients' breasts (without bras) to judge whether or not they got best intermammary cleavages. We also observed if or not the most lateral margins of the breast were on the area of AAL. All patients signed the informed consents.

Results

Among 560 patients, 62 patients chose round implant from 175 ml to 300 ml with W from 10.5 cm to 12 cm. Their CDs are from 14.5 cm to 16 cm. The other 498 patients chose anatomic implants from 220 g to 320 g with W from 10.5 cm to 12.5 cm. Their CDs are from 14.5 cm to 17 cm. 78% of the patients have got followed up from 1 month to 5 years postoperatively. Their intermammary cleavages are between 1 cm and 2.5 cm without wearing bras. If wearing tight bras, 90% of the patients got their two breasts connecting with each other, which was the most satisfied part of their new breasts. All patients' lateral margins of the breast are not exceeding the AAL laterally. Figure 3a-3d shows a typical case. All patients are satisfied with their new nature breast shape and volume except for four patients who got unilateral capsular contractions.

Discussion

Why W = CD − 4 (or 3.5) (cm). Figures 4 and 5 (a, b, c, d are defined) shows the reasons. "a" (1.5 cm) is the NTZ. As we mentioned before, any sharp dissection with electric cautery within the NTZ could have a high possibility of damaging the vessel perforators and uncontrolled bleeding, especially through the transaxillary incision with endoscope. Because the broken artery will shrink into the deep muscles and electric coagulation could not work probably, ligation of the artery is sometimes needed. Dissection of NTZ could also induce the palpation of the implant edge, even the symmastia.[8-10] Although some experienced doctors could reach out of the margin of NTZ a little bit without complications, as a rule, the NTZ should be highly respected.

"b" (0.5 cm) is the "death cavity," which means the most medium part of the dissected implant pocket is an acute angle area. The baseline of the acute angle is the rib that cannot be elevated. In contrast, the serratus anterior muscle on the most lateral implant pocket's baseline part (red line in "c" of Figure 5) could be elevated. When the implant is put into the pocket, the round implant edge is not sharp enough to fulfill this "b" area, especially for the anatomic implant. This small death cavity will be fulfilled by tissue ingrowth post-operatively. This situation also happens in the lowest part of the implant pocket.[11]

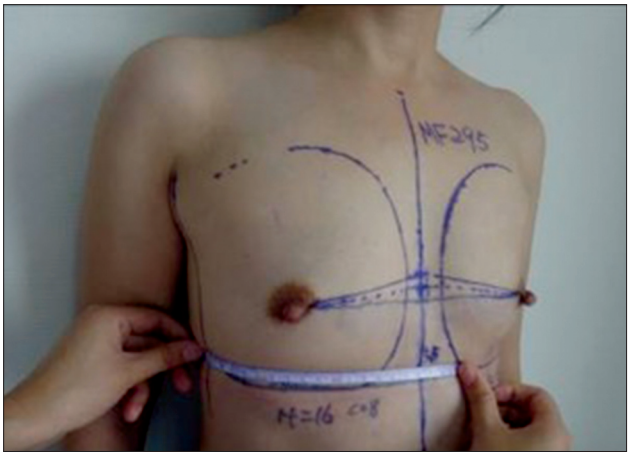

Figure 1: The method to measure CD on the inferior mammary fold level.

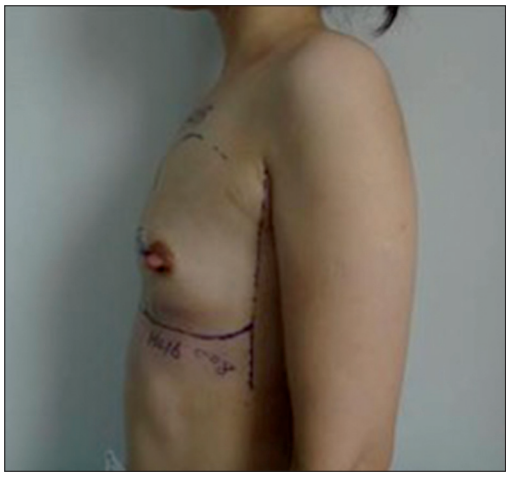

Figure 2: The location of the anterior axillary line.

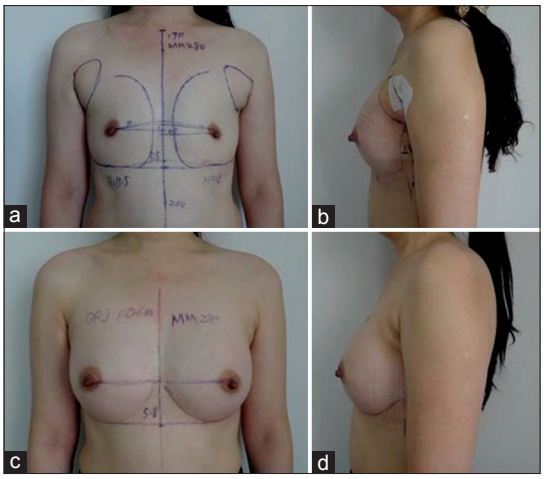

Figure 3: (a) Typical case 3a: Frontal view preoperatively W = CD (16 left/15.5 right) – 4 = 12 (cm). Allergan 410 MM280. We add 0.5 cm to the right W; (b) Lateral view 1 week follow-up postoperatively, the black arrow indicating the anterior axillary line moving forward about 1 cm; (c) Frontal view 6 months follow-up postoperatively; (d) Lateral view 6 months follow-up postoperatively, the most lateral margin of the breast is on the postoperative anterior axillary line.

What is "c"? As we mentioned above, unlike lying on the ribs medially, the implant is lying on the part of serratus anterior muscle laterally. When the implant is inserted into the dissected pocket, because of the projection of the implant, the part of lateral serratus anterior muscle (c) will "stand up" to embrace the implant. We call this phenomenon "width become height" [Figures 4 and 5]. Suppose the most lateral edge of the implant is point "e" shown in Figure 4, dissecting should be done about 1 cm more laterally on the top of serratus anterior muscle (red line of c) to let "c" stand. In the postoperative pictures [Figure 3c], we could see the AAL move forward (black arrow), which is another proof of "width become height." Even though the preoperative AAL is moved forward a little bit after the implant is put in, the most lateral border of the new breast is still on the postoperative AAL if the patient has a certain amount of lateral soft tissue. For those patients with relatively thin lateral soft tissue, the most lateral border of the new breast is probably about 1 cm away from the post-operative AAL. But that is fine because if we add 1 cm to W, the implant will be too big for the patient. For example, if CD = 16 cm, then the W = CD − 4 = 16 − 4 = 12 (cm). In this situation, for the Allergan 410 implants, we should choose implants no bigger than 300 g. But if we add 1 cm to 12 cm, then we have to choose implants over 300 g, which is too big for patients with CD of 16 cm. As we know, most Chinese women do not like too big and unnatural breasts.

"d" represents the thickness of the soft tissue on the lateral side of the pocket, which is about 1 cm for regular patients and 0.5 cm for very thin patients. So finally, we got the formula:

$$W = CD - (a + b + c + d) = CD - (1.5 + 0.5 + 1 + 1 \text{ or } 0.5) = CD - 4 \text{ (or } 3.5) \text{ (cm)}.$$

Most of women like to have their two breasts contacting with each other when they are wearing bra. If we suppose the soft tissue in NTZ is very flat and thin like a piece of paper, the narrowest intermammary distance should be 3 cm. To produce the best intermammary cleavage, the only thing that the doctor could do is to let the medium border of the implant reach the point 1.5 cm away from the middle line, in spite of the existing "b" part. The more soft tissue around the NTZ, the narrower intermammary distance will be, and the more likely the two new breasts would contact with each other postoperatively. The doctor could not totally control it and should let their patients know the fact. If you do this kind of communication with your patients preoperatively, it will greatly improve your patients' postoperative satisfaction rates. Sometimes in order to get narrower intermammary cleavage, the authors had to use blunt dissecting technique to surpass the limit of NTZ about 0.5 cm and found that under endoscope some perforators remain intact [Figure 6]. But for young surgeons, this should not be encouraged. We also recommend using blunt dissecting technique on the lateral side of the pocket to avoid the damage of the intercostal nerves.[12] The more you dissect the lateral side of the pocket, the more likely you will damage the intercostal nerves.[13] This is another reason why we choose the AAL as the lateral border of the new breast.

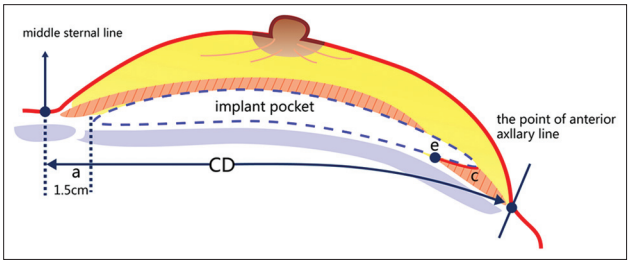

Figure 4: The "a" is 1.5 cm, the half of no touch zone. The point "e" is supposed to be the most lateral margin for the implant. The "c" is part of serratus anterior muscle.

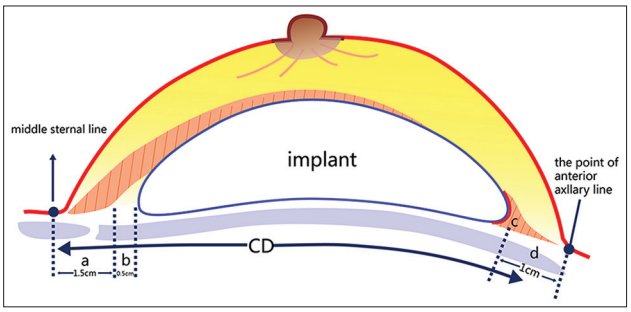

Figure 5: W (implant width) = CD − (a + b + c + d) = CD − (1.5 + 0.5 + 1 + 1 or 0.5) = CD – 4 or 3.5 (cm). The serratus anterior muscle (flat red "c") becomes upright because of the implant projection. The "b" is "death zone that implant edge could not reach to". The "d" is lateral thickness of soft tissue, which is about 1 cm for regular patients and about 0.5 cm for very thin patients.

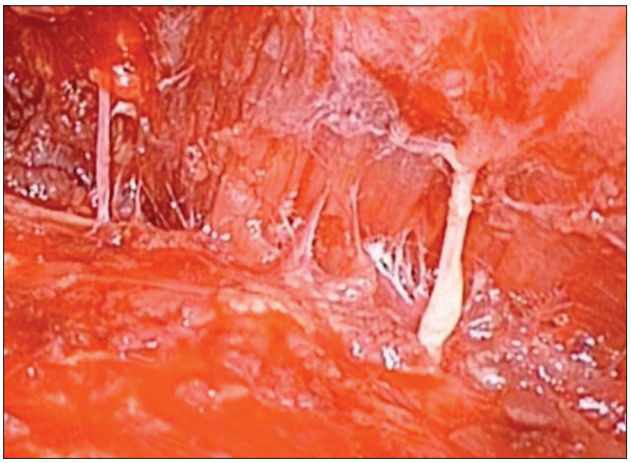

Figure 6: Endoscopic view: The vessels are not broken after blunt dissection on medium part of implant pocket.

Most of the plastic surgeons get used to take BW (base width of the existing breast parenchyma) as the main factor to determine W.[14-16] Dr. Dennis C Hammond thinks: W = BW − 1/2 (medium tissue thickness + lateral tissue thickness).[17] The author does not use the method because of the following reasons:

1. The concept of BW is not very clear. Sometimes it is defined as the base width of the existing breast tissue, sometimes it is defined as the distance between the medium and lateral margins when displacing the breast parenchyma medially and laterally.[18] The above two

ways will produce different BWs, and only those experienced surgeons could be skilled at it.
2. The BW does not concern about the NTZ. Some patients' medium points of the breast widths are within the NTZ.
3. For some patients with very small amount of breast parenchyma or contracted breast, the BW is either very small or it is hard to recognize the border of the breast base.
4. BW is always measured with calipers, so it is a straight-line distance. The chest wall is not straight but curved, and the implant is lying on the curved chest wall, so curved distance is more reasonable.

The "CD − 4" theory cannot be applied to the patients who need to do subfascia[19,20] or subglandular breast augmentation. In these cases, the patients will always have enough breast tissue for doctors to measure clear BWs. In such situations, the W ≤ BW.

When a patient's chest wall is much wider on the upper part and narrower on the lower part, we need to add 0.5 cm to the CD. Because we should consider that the transverse diameter of the implant should be at the nipples level, but not the IMF level. However, this situation is not common.

Finally, we should know that the theory "CD − 4" should be regarded as a principle of choosing W. It is not a precise or accurate formula that you must always obey in clinics. Sometimes you could add or subtract 0.5 cm or even more from the "CD − 4" according to the patients' situations and still achieve good results. But as a rule, the theory should be respected. It is also easy to be grasped by plastic surgeons.

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