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ORIGINAL ARTICLE

# Natural mastopexy repositioning based on age-related mean breast shape

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**KEYWORDS**
breast;
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**Summary** *Background:* The most important element during breast reconstruction preoperative planning is determining the new position and shape of the breast. A youthful breast with no signs of ptosis may not necessarily be the ideal breast for women of all ages. However, indicators have not been established on how breasts should be positioned depending on age. We investigated and reported on the proper positioning of the breasts based on age during breast reconstruction using mean age-based data from three-dimensional (3D) modeling.
*Methods:* We photographed 110 breast cancer patients using a compact 3D scanner and calculated the measured means. Data were grouped according to age group. Three-dimensional simulation images from all patients were reconstructed from the data. Breasts from all age groups were divided into healthy and affected breasts. For each measured value, the means of the two groups were compared.
*Results:* There were no major differences in the mean values in the 30s, 40s, and 50s age groups. Major changes were noted in the 60s age group compared with the 30s, 40s, and 50s age groups. There were no statistically significant differences between healthy and affected breasts.
*Conclusions:* This is the first study to use a 3D method to calculate the means based on age group. This study showed that particular attention should be paid to age-related changes during breast reconstruction surgeries for women aged ≥60 years. We believe that the method used in our study on mean breast shape based on age group can be used as a reference or indicator to ensure that the reconstruction of natural breasts befits the age of the patient.


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## 1. Introduction

In breast reconstruction, breast reduction and mastopexy of the healthy side are often required to achieve bilateral symmetry of the breasts. The most important element during preoperative planning in such situations is determining the new position and shape of the breast. Textbooks document breast measurement data for what is considered a beautiful breast and can be referred to as an indicator during the preoperative planning of breast design. With age, the breasts become larger, the upper pole fullness is lost, and signs of ptosis appear. However, indicators have not been established on how breasts should be positioned depending on age, and, at present, surgeons are expected to make a decision on the basis of their experience. Several papers have measured breast sizes and calculated the means to provide some indicators for use as reference values,[1–3] but these numbers do not take age into consideration. We investigated the proper positioning of the breasts based on age during breast reconstruction using age-based mean data from three-dimensional (3D) modeling.

## 2. Patients and methods

This study was approved by the hospital institutional ethical committee, and informed consent was obtained from all patients. We photographed 110 breast cancer patients who presented to our outpatient clinic from April 2014 to April 2015. The right breast was affected in 56 patients, the left breast was affected in 48 patients, and both breasts were affected in six patients. Age ranged from 26 years to 73 years, with a mean of 47.5 years. All patients were breast cancer patients of $\leq$ Stage II and none had a history of preoperative chemotherapy or breast surgery, including partial excisional biopsy history. However, history of needle biopsy was not considered because it did not seem to affect the breast shape.

Before their surgery, we calculated the measured means of the following eight items that were obtained from 3D images: breast volume; width; height; projection; distance from the sternal notch to the nipple (S-N); distance from the sternum nipple level to the nipple (M-N); distance from the nipple to the inframammary fold (N-IMF); and angle formed by a line drawn from the sternal notch to the sternal notch nipple line (Angle N; Figure 1). Of these, S-N and M-N were determined from the numbers derived from the XY plane. Because IMF is in a hidden position, N-IMF 3D measurements were inaccurate, and linear measurements were conducted instead.

Photographs were obtained using a compact 3D scanner KINECT (Microsoft, Redmond, WA, USA), and the data were processed using capture software ARTEC Studio Pro (Artec 3D, Luxembourg, Luxembourg), which was developed for high precision 3D scanners. The image data were analyzed using Breast Rugle (Medic Engineering, Kyoto, Japan) analytical software. During the analysis, one doctor was responsible for determining which landmarks to use and preparing the virtual chest wall. All patients were photographed in a normal anatomic standing position.

Measurement data were grouped on the basis of age group, and the respective means were calculated. For each measured value, age groups were compared using the Steel–Dwass test. Breasts from all age groups were divided into healthy and affected breasts, and means of the various measurements were calculated. For each measured value, the means of two groups were compared using the Student *t* test. A *p*-value of $\leq$0.05 was considered statistically significant. All statistical analyses were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan).

## 3. Results

Data were analyzed according to standard statistical methods. The overall means for all patients based on age group are shown in Table 1. The measurements for each age group were compared, excluding the 20s and 70s age groups, where $n = 1$. Mean values for the 30s, 40s, and 50s age groups revealed no clear patterns by age, and there were no statistically significant differences between the groups. However, in the 60s age group, although height, M-N, and angle N showed no statistically significant differences compared with that in the 30s, 40s, and 50s age groups, other measurements showed statistically significant differences and showed a major increase (Figure 2).

The reconstructed 3D simulation images for the mean breast shapes based on age group for all patients are shown in Figure 3. Measured data did not reveal any major differences among the 30s, 40s, and 50s age groups. However, as age increases, associated aging changes are more likely to appear in the breasts. Measurement results were separated into affected and healthy breasts, and there were no statistically significant differences between them (Table 2).

## 4. Discussion

During breast reconstruction, breast reduction and mastopexy of the healthy breast may often become necessary to maintain bilateral symmetry of the breasts. One of the most important elements during preoperative planning is determining the new position and shape of the breast. There are several surgical techniques for breast reduction and mastopexy, such as periareolar, vertical, and inverted T incisions; some studies have reported on how to establish the nipple position, which provides an indicator for the preoperative design. A line is drawn from the clavicle or sternal notch to the nipple, a specific distance is designated along that line,[4–6] and the position is determined on the basis of the IMF position or midpoint of the humerus.[7–12] There are several other methods,[13] but, in the majority of these, designs are solely based on esthetically perfect breasts, and none of them take natural aging into account.

In general, as breasts age, they become larger, the upper pole fullness is lost, and ptosis is observed. Regnault's breast ptosis classification is typically used to evaluate these changes.[14] Aging effects are thought to be caused by the weakening of the fascial ligamentous support system of the breast and not merely by sagging skin.[15] We believe that these aging phenomena are not necessarily unattractive and represent *naturalness befitting the age*. Allow us to consider what *naturalness befitting the age* should look like.

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