Evaluation of the Effect of Reduction Mammoplasty on Body Posture in Patients with Macromastia

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ABSTRACT

Background: Breast hypertrophy is a significant health problem with both physiological and psychological impacts on the patients' lives. Patients with macromastia adopt a corrective posture due to the effect of the breast on the center of gravity and possibly in a subconscious effort to conceal their breasts.

Objective: This study aimed to evaluate whether the posture of patients with macromastia changed after the reduction of mammoplasty.

Material and Methods: In this prospective study, patients with breast cup sizes C, D, and DD were scheduled for reduction mammoplasty in 3 Shiraz University Hospitals. Age, weight, height, and preoperative cup sizes of the breasts were recorded for every patient, and all patients underwent posture analysis with forceplate before and after reduction mammoplasty. Finally, the preoperative and postoperative data were compared.

Results: Mean age at the time of reduction mammaplasty was 43.57±9.1; the mean pre-operation, such as weight, height, and mean the body mass index (BMI) was 76.57±10 kg, 158.28±6 cm and 30.57±4.1, respectively. The average Anterior-posterior (AP) direction velocity before and after the surgery was 0.85±0.12 cm/s and 0.79±0.098, respectively. These values were 0.83±0.09 and 0.81±0.10 for the medio-lateral direction. The Detrended Fluctuation Analysis (DFA) value for the AP direction was 1.63±0.3 and 1.60±0.2 for pre-and post-surgery, respectively, which was not statistically different. The DFA value for maximum likelihood (ML) direction was 1.65±0.2 and 1.48±0.2 in pre-op and post-op, respectively, which was statistically significantly different.

Conclusion: Reducing the weight of enlarged breasts can correct disturbed sagittal balance and postural sway.

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Keywords

Macromastia; Musculoskeletal Pain; Posture; COP; Detrended Fluctuation Analysis; Wise Pattern; Superomedial Pedicle; Mammoplasty

Introduction

Breast hypertrophy is a significant health problem with both physiological and psychological impacts on the patients' lives [1]. Despite an unclear definition of breast hypertrophy, it is characterized by increasing weight and volume of breast tissue compared to normal proportions [2]. Moreover, the reason for breast hypertrophy is still unknown, especially during early adolescence and puberty [2].

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Patients affected by macromastia often suffer from chronic shoulder (95%), neck pain (95%), back pain (92%), and recurrent intertrigo in mamillary folds [3,4]. Many patients exhibit emotional or psychosocial complaints, which are the main reasons to affect patients' quality of life [5].

Most patients gain satisfaction after reducing mammoplasty due to its effect on both musculoskeletal and social complaints and have a positive outcome from surgery [5,6]. The reduction of the mammoplasty results in significantly decreasing breast pain, breast pain, bra grooving, inframammary fold intertrigo, and rash [7].

However, the obtained results are according to the patient's subjective perception, these data are valuable, and the findings do not provide an exact explanation for the beneficial effect of the reduction mammoplasty on the musculoskeletal system. There are limited studies to objectively measure and evaluate the physiologic effect of reduction mammoplasty. For example, it is not clearly known how the reduction of mammoplasty affects posture and alignment of the body, and how is related to improvement in neck and shoulder pain.

Based on the results obtained by Foreman et al. low back compression force decreased approximately 35% through a lifting task after reducing mammoplasty [8]. Further, the study of Findikcioglu et al. showed that both thoracic kyphosis and lumbar lordosis were higher in women with size D bras compared to those with B, A, or C bra sizes [9].

The changes in the center of gravity location were investigated in women undergoing mammoplasty and posture using static stabilometry improved [10, 11]. Little data is on the precise influence of macromastia on the posture of the body; changing posture causes the symptoms of pain in patients.

Women with macromastia selected a corrective posture because of the breast effect on the gravity center and likely on a subconscious effort to mask breasts [12-14]. The current study aimed to investigate whether the patients' posture with macromastia changes after decreasing mammoplasty.

Material and Methods

This prospective study was conducted on patients, serving as their controls; postural sway characteristics in the patients were investigated pre-and post-surgery, and the pre-and post-tests were done approximately 15 days before reducing mammoplasty and 60 days after surgery. In addition, the current study was approved by the Ethics Committee of Shiraz University of Medical Sciences.

Patients with D, DD, and C breast sizes were planned to decrease mammoplasty in the Shiraz University Hospitals. Furthermore, exclusion criteria were musculoskeletal diseases, such as spinal disk herniation, ankylosing spondylitis, congenital scoliosis or kyphosis, and rheumatism. Patients who had previously undergone back surgery, and those with neurological or motion disorders and with a history of previous reduction mammoplasty were excluded from the study. All of the breast reductions were based on a Wise pattern and a superomedial pedicle. Finally, a total of 20 patients participated in the current study.

The pains, including shoulder, neck, and low back pain were assessed in every patient with a Nordic questionnaire before operation and 2 months after the operation. Some characteristics of patients, such as height, weight, age, and cup size before and after operation were measured; the body mass index (BMI) was computed in kg/m^2 as well.

Each subject performed a postural examination before and 2 months after the surgery. Postural sway was measured by using a Kistler forceplate (9260AA, Kistler instruments, AG Winterthur, Switzerland). Raw signals were digitized by an Analog to Digital Converter (ADC) with the sampling rate of 200 samples/s and saved on a computer for offline analysis. All offline analyses were performed in Matlab (Mathworks, Natick, MA). The

center of pressure (COP) was calculated by the formula provided by the forceplate manufacturer.

Subjects stood on the forceplate for 60 s with their normal standing posture and preferred based on support (foot placement).

COP is known as a signal rich in information, including dynamics of postural control. In the current study, the sway velocity not only was measured, but also calculated the dynamics of postural sway by performing Detrended Fluctuation Analysis (DFA) on the COP trajectories (separately for each axis of motion).

The details of this method and its applications for postural studies were discussed elsewhere [15].

An increase in DFA value leads to a decrease in the complexity of COP dynamics. "Complexity" of a dynamical system was determined through changes in the correlation in the longer time scales, showing that lack of complexity results in less versatile motor programming [15]. Therefore, a decrease in DFA compared to its normal value would suggest simpler and less robust motor control strategies [16].

The preoperative and postoperative data were compared using the paired T-test. The *P*-values≤0.05 were considered statistically significant, and all data are presented as mean±standard deviation.

Results

The mean age at the time of reduction mammaplasty was 43.57±9.1, and the mean preoperation weight was 76.57±10 kg; the mean height was 158.28±6 cm, and their mean BMI was 30.57±4.1.

The cup size ranged from C to DD with an average D, and bust diameter was from 85 to 105 cm with an average of 95 cm. Reduction mammoplasty was significantly effective in reducing musculoskeletal pain (Table 1). Musculoskeletal pain in all patients with BMI>30 was completely ameliorated after reduction mammoplasty. However, patients with BMI 25-28 did not have benefits from the operation for the relief of their musculoskeletal pain. Improvement of pain symptoms didn't have any relation to breast size (Figure 1).

COP velocity was calculated from the trajectory. The average Anterior-posterior (AP)

Table 1: Effect of reduction mammoplasty on musculoskeletal pain

	Shoulder pain (%)	Neck pain (%)	Low back pain (%)
Before Operation	72	75	87
After Operation	28	25	13

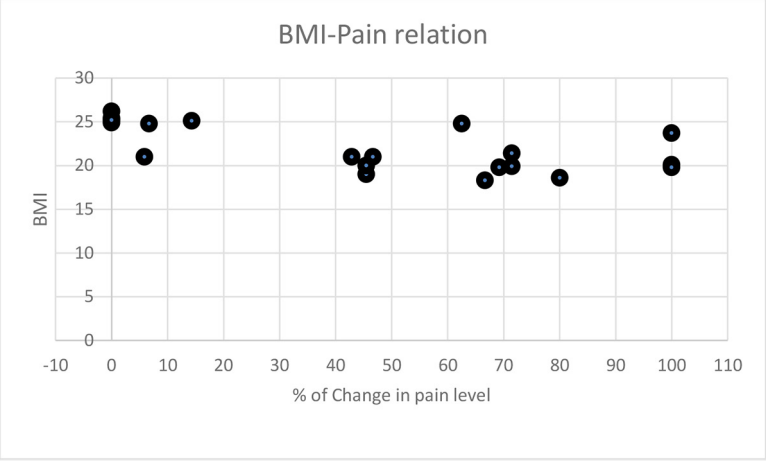

Figure 1: Changes in neuromuscular pain level in response to reduction mammoplasty

direction velocity before and after the surgery was 0.85±0.12 cm/s and 0.79±0.098, respectively. Moreover, they were 0.83±0.09 and 0.81±0.10 for the mediolateral direction. Statistical analysis did not yield any significant difference between pre-and post-surgery in any of the directions of COP velocity. The DFA value for the AP direction was 1.63±0.3 and 1.60±0.2 for pre-and post-surgery, respectively, which was not statistically different. The DFA value for the maximum likelihood (ML) direction was 1.65±0.2 and 1.48±0.2 in pre-op and post-op, respectively which was statistically significantly different.

Discussion

The current study aimed to determine whether musculoskeletal pain and postural sway change in patients with symptomatic macromastia after decreasing mammoplasty.

Some studies have shown significant alleviation of pain after the reduction of mammoplasty [17]. The obtained results also showed a significant reduction in the neck, shoulder, and back pain after operation in patients with pre-op BMI>30. However, the exact physiologic mechanisms, which are responsible for the pain creation due to macromastia and pain improvement after mammoplasty, are not still defined.

The study by Spector and Karp et al. showed back pains significantly improved after decreasing less than a total of 1,000 g of breast tissue, and even small decreases were effective to improve musculoskeletal complications along with macromastia [18].

Fatigue was considered in trunk extensor muscles through low-level activity, and electromyography (EMG) testing revealed that the levels of sustained mean activity, which were as low as 2% EMG max, could result in muscular pain [19] due to induced fatigue. In addition, more load on the upper torso can significantly have an increase in background activity of paravertebral muscles by 2% of EMG max, leading to fatigue as well as pain [20]. Tenna et al. revealed postural stabilization improved after decreasing mammoplasty in terms of muscle activity modification using static stabilometry, leading to a decrease in back pain after surgery [21].

The obtained findings inconsistent with these studies showed that surgical procedure would cause a relatively immediate change in BMI, which could change the Center of Gravity location and the dynamics of the COM. However, the location and possible change of location of the COM are not measured, it is likely that this procedure affected the location of the COM. Further, the dynamics of the postural sway of patients showed a significant change after the surgery. The current finding of changes along the mediolateral direction of the COP dynamics is consistent with previous findings [21], showing the control strategies of the ML and AP components of postural sway follow different mechanisms. Other studies have also shown that ML trajectory provides more information about the risk of fall compared to AP direction [22].

In the present study, the pain level and posture improved after decreasing mammoplasty because of not only changes in body mass and redistribution of torso mass but also increasing self-esteem and psychological modifications considering body image as well as anxiety reduction. Breast hypertrophy was mostly associated with kyphosis since patients want to conceal those that are considered an embarrassment source. A new breast size leads to eliminating previous dissatisfaction with body image, decreasing, and increasing anxiety and self-esteem, respectively. Improvement of body image and decrease in weight of the anterior part of the body results in correcting this postural disorder.

However, breast hypertrophy is known and accepted as an abnormal condition, decreasing mammaplasty is not certainly accepted as a reconstructive or cosmetic process. Further, many prospective studies have shown that positive health correlated with decreas-

ing mammoplasty outcomes [23]; there are not any conclusive guidelines to define clearly solid variables that clinicians can establish if the process is necessary medically. Therefore, insurance companies do not mostly accept patients without the arbitrary need to determine medical necessity; however, they have obvious symptoms. The present study aimed at providing scientifically the musculoskeletal burdens of breast hypertrophy in the patient and also measuring postural stability based on the forceplate, determining the necessity of patients' therapeutic decrease mammoplasty.

Conclusion

Hypertrophic breasts are considered a cosmetic and a functional problem, complicated according to the pathologic situations in the musculoskeletal system, leading to postural abnormalities. The reduction of the non-physiologic weight of large breasts, located anterior to the main axis of the body, might cause a correction in malalignment of the musculoskeletal system and disturb the sagittal balance and postural sway.

Authors' Contribution

A. Fazelzadeh conceived the idea. The method implementation was carried out by A. Fazelzadeh and A. Mohammadi. F. Khademi gathers the images and the related literature. Results and data analysis were carried out by B. Tahayori. The research work was proofread and supervised by A. Mohammadi. All the authors read, modified, and approved the final version of the manuscript.

Ethical Approval

The Ethics Committee of Shiraz University of Medical Sciences approved the protocol of the study (IR.SUMS.MED.REC.1399.6.9).

Informed Consent

All participants signed the consent form before entering the study.

Conflict of Interest

None

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