Effects of Breast Augmentation on Pectoralis Major Muscle Function in the Athletic Woman

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Background: Techniques for augmentation mammoplasty commonly involve incisions through at least a portion of the pectoralis major muscle. The effects of implant position and surgical release of the muscle origin have not been thoroughly addressed.

Objective: In this study the authors report on a group of female athletes, for whom pectoralis major muscle function is particularly important, and attempt to quantify their experience with augmentation mammoplasty.

Methods: Twenty female athletes who spent at least 6 hours per week weight training filled out a 1-page questionnaire dealing with issues such as ability to perform various exercises after breast augmentation, pain during exercise, and breast appearance during exercise.

Results: Women who reported implant location as “under the muscle” required an average of 7.2 weeks before they could resume their normal weight-room routines. Five of 7 women in the “under the muscle” group reported a decrease in their ability to perform pectoralis major–dependent exercises; 1 woman reported increased ability. Two of 7 women in this group reported pectoral pain with at least 1 of the 3 queried exercises and said they now refrain from performing those activities. Three women noticed breast firmness. Five of the 7 women said they would have implants placed in the same position again. Women who described implant position as “above the muscle” required an average of 3.8 weeks before they could resume their normal weight-room activities. Five of 13 women reported an increase in their ability to perform the 3 queried pectoralis major–dependent exercises, whereas only 1 reported a decrease in ability. None reported pectoral pain with any of the 3 exercises. Two of the 13 women noticed tightness of their implants. Twelve of 13 said they would have implants placed in the same position again.

Conclusions: These data suggest a longer recovery period for implants placed under the muscle before return to preoperative weight training activity. Placement under the muscle is also associated with reports of decreased performance in exercises dependent upon the pectoralis major muscle. Overall satisfaction with breast augmentation was high regardless of implant location. (Aesthetic Surg J 2004;24:224-228)

Despite the recent increase in popularity of the subpectoral technique for placement of breast implants, the ideal position of mammary prostheses in breast augmentation remains controversial. The 2 most popular techniques are the subpectoral and sub glandular approaches, although a smaller group of surgeons prefers total sub muscular placement. Proponents of each technique have emphasized that their preferred approach reduces the incidence of certain problems associated with augmentation procedures, including capsular contracture,1-3 implant displacement,4 implant rippling,5 implant show,6 and interference with mammography.7

One important consideration, however, has been overlooked: postoperative function of the pectoralis major muscle. The question of how implant position or release of the muscle origin affects the function of this muscle has never been adequately addressed.

The pectoralis major muscle originates along the medial third of the clavicle, the lateral sternal border, ribs 1 through 6, and the external oblique fascia. It inserts along the lateral lip of the bicipital groove of the humerus. It serves to adduct, medially rotate, and, to a lesser extent, flex the arm. This muscle provides the bulk of the power required in bench-press, butterfly, and push-up exercises. It also plays a critical role in such coordinated activities as swimming, racquet sports, and the martial arts.
Most subpectoral techniques require release of the pectoralis major muscle from at least a portion of the costal margin. To avoid the problems associated with high-riding implants and lateral implant displacement, the muscle incision is often extended superomedially to include the lower sternal origin.8

What we do not know is how this incision through the pectoralis major muscle affects the muscle’s postoperative function. We asked this question of a population for whom pectoralis major performance is important, and their responses are reported here.

Methods

We conducted a retrospective study of 20 female bodybuilders who specifically trained the chest-muscle group and had also undergone augmentation mammoplasty. They were asked a series of questions in the form of a check-box survey. Most of the participants were contacted through physical trainers at several central Florida gyms. Only women who specifically trained the chest-muscle group at least 1 day per week were included. Additional responses were obtained from contestants in a national bodybuilding competition. Participating women were asked to fill out a 1-page checkbox survey. We made no attempt to distinguish subpectoral from total submuscular implant location because most of the participants did not have that particular information.

Results

The study population ranged in age from 19 to 42 years, with a mean of 28.9 years (Table 1). The women spent between 6 and 20 hours a week exercising, with a mean of 10.35 hours per week. Seven of the 20 women reported their implant location as “under the muscle”; the other 13 reported their implant location as “above the muscle.”

The 7 women who listed their implant position as “under the muscle” ranged in age from 21 to 43 years, with a mean of 28.6 years. They spent between 6 and 11 hours per week exercising, with a mean of 8 hours. Implant age varied from 4 months to 11 years, with an average of 5.5 years. Time elapsed between surgery and resumption of normal weight-room activities ranged from 5 to 12 weeks, with an average of 7.2 weeks. None of these women reported an increase in their ability to perform bench presses or push-ups, and 5 of 7 reported a decrease. One of the 7 women experienced an increase in performance in butterfly exercises, whereas 4 of 7 reported a decrease. Two of 7 women said they experienced pain while performing bench-press, push-up, and butterfly exercises. Six of 7 said they believed that their implants looked natural when they exercised; the other respondent described visible medial rippling of an implant (Table 3). Three of 7 reported that their implants felt hard. Five of the women said they would have implants placed in the same position again.

Table 1. Study population attributes

<table>
<thead>
<tr>
<th>Implant location</th>
<th>No. of patients</th>
<th>Average age (y)</th>
<th>Average workout duration (h/wk)</th>
<th>Average time elapsed between surgery and return to regular workouts (wk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below muscle</td>
<td>7</td>
<td>28.6</td>
<td>8</td>
<td>7.2</td>
</tr>
<tr>
<td>Above muscle</td>
<td>13</td>
<td>29.1</td>
<td>11</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Table 2. Exercise performance

<table>
<thead>
<tr>
<th>Implant location</th>
<th>Bench press</th>
<th>Push-ups</th>
<th>Butterfly</th>
<th>Pain with exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increased ability</td>
<td>Decreased ability</td>
<td>No change</td>
<td>Increased ability</td>
</tr>
<tr>
<td>Below muscle</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>(n = 7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above muscle</td>
<td>5</td>
<td>1</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>(n = 13)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
The 13 women who reported their implant position as above the muscle ranged in age from 19 to 42 years, with a mean of 29.1 years. They spent between 6 and 23 hours per week working out, with a mean of 11.6 hours per week. Implant age ranged from 6 months to 12 years, with an average of 2.8 years. Time elapsed between surgery and resumption of normal weight-room activities ranged from 4 days to 8 weeks, with an average of 3.8 weeks. Five of the 13 women reported an increase in bench-press ability; 1 reported a decrease. Five women also described an increase in push-up ability; 1 of the 13 reported a decrease. Five of the 13 reported an increase in performance in butterfly exercises; 1 of 13 showed a decrease. None of the women reported experiencing pain while performing these exercises. Nine of 13 said they believed that their implants looked natural when they exercised. Seven reported visible rippling of an implant, 2 medial and 5 lateral. Two women reported breast firmness. Twelve of the 13 said they would have implants placed in the same position again.

### Discussion

Although our study population was small and the data subjective, we believe that findings from the responses of this group of female athletes merit discussion. The data suggest 2 notable differences between the under-the-muscle and above-the-muscle groups: disparities in recovery time and ability to perform exercises involving the pectoralis major muscle.

The difference in recovery time of 7.2 weeks in the

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**Table 3. Implant characteristics**

<table>
<thead>
<tr>
<th>Implant location</th>
<th>Average implant age (y)</th>
<th>Subjective hardness</th>
<th>Visible rippling</th>
<th>Natural look during exercise</th>
<th>Overall satisfaction with implant position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below muscle</td>
<td>5.5</td>
<td>3/7 (42%)</td>
<td>1/7 (14%)</td>
<td>6/7 (86%)</td>
<td>5/7 (71%)</td>
</tr>
<tr>
<td>Above muscle</td>
<td>2.8</td>
<td>2/13 (15%)</td>
<td>2/13 (15%)</td>
<td>9/13 (69%)</td>
<td>12/13 (92%)</td>
</tr>
</tbody>
</table>

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**Figure 1.** Rotating magnetic resonance imaging (MRI) at the level of the fifth rib in a patient with a subpectoral implant at rest (A, C, E) and during pectoralis major muscle flexion (B, D, F). The muscle is notably absent (red arrow).
under-the-muscle group compared with 3.8 weeks in the above-the-muscle group is most likely explained by the muscle incision itself. It is logical to assume that surgical alteration of the muscle being tested would necessitate a longer healing period than that required for a procedure in which the muscle is not altered. The recovery period of 7.2 weeks in the under-the-muscle group is consistent with recovery times reported in a recently published study. It is noteworthy that the quickest return to a “normal” weight-room routine—4 days—was reported by a patient whose implants were inserted through the umbilicus and placed in a subglandular position.

The second difference between the 2 groups probably has broader implications for this particular population. Compared with their above-the-muscle counterparts, women with below-the-muscle implants were more likely to report a decline in their ability to perform exercises involving the pectoralis major. In addition, 2 of 7 women with below-the-muscle implants quit training the chest-muscle group altogether because of pain. These data suggest that within this population, an above-the-muscle location is less likely to have a detrimental effect on a woman’s ability to perform pectoralis major–dependent exercises, is more conducive to this ability, and is less likely to be associated with pain during these exercises.

In an effort to provide an explanation for the these results, we considered possible alterations in pectoralis major mechanics resulting from each implant location. One factor that may affect pectoralis major performance is surgical disruption of the muscle origin (Figures 1 and 2). In our opinion, the extent of muscle incision must specifically address the needs of each individual patient. Too little muscle incision can lead to lateral implant displacement with each muscle contraction, whereas too much could compromise pectoralis major performance.

A second possible explanation is that the placement of the implant beneath the muscle creates a mechanical disadvantage. With the initiation of muscle contraction, the implant is compressed until a stable platform is created. This act requires energy, and only after it is accomplished can the remainder of the muscle’s effort be translated into movement. It would be interesting to examine the implant-rupture rate in this same population. Does a thicker, more developed pectoralis major muscle affect the rate of rupture of subpectorally placed implants?

The size of the implant may also affect pectoralis major function. By its very location, the subpectoral implant changes the muscle’s vector of contraction from a straight line to an arc (Figure 3). This theoretically
makes the muscle longer, thereby creating a less favorable length-tension relationship.

Another possible explanation is that intramuscular scarring affects performance. This possibility may be extrapolated from structural findings in patients who have undergone breast reconstruction. Gur et al.9 conducted a histologic analysis of pectoralis major specimens at different stages of subpectoral tissue expansion. They found electron-microscopic evidence of muscle-fiber degeneration and noted glycogen and interstitial fibrosis in all 20 study specimens compared with their preexpansion appearance.9 A similar process may occur in the augmentation population; at least some degree of muscle expansion occurs with subpectoral placement.

Each of these explanations remains to be tested. We mention them as potential directions for further study. We were pleased to see a recent article by Beals et al.10 in which the authors make an effort to quantify pectoralis major function both before and after subpectoral augmentation. It would be interesting to apply their testing model to our population and study this group in a more prospective fashion.

Conclusion

Our data suggest a longer recovery period before return to preoperative levels of weight-training activity among patients whose implants are placed under the muscle. Placement under the muscle is also associated with reports of decreased performance in exercises that depend on the pectoralis major muscle.

The small group of female bodybuilders we studied voiced a high level of satisfaction with their augmentation procedures, regardless of implant position. Nevertheless, given these findings, we suggest that patients who undergo augmentation, particularly those for whom pectoralis major function is important, be informed of the potential compromise in pectoralis major function associated with the under-the-muscle technique.

References


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