Breast Reconstruction Information

TIMING OF BREAST RECONSTRUCTION

Is immediate reconstruction appropriate?

Current trends towards less radical surgery for breast cancer, preserving the pectoralis major muscle and overlying skin, along with better reconstructive techniques, have made breast reconstruction at the time of mastectomy a standard procedure. All of the reconstructive techniques traditionally available can be safely performed in the immediate setting. Several studies have shown that the addition of a reconstruction does not delay adjuvant systemic therapy or interfere with the monitoring of the mastectomy site for possible local recurrence.

What are the advantages of immediate reconstruction?

Frequently, the results of immediate reconstruction are cosmetically superior to delayed reconstruction due to careful planning of incisions and skin preservation by the collaborating oncologic and plastic surgeons. The economic advantage of immediate reconstruction is obvious because the cost of a second hospitalization is eliminated.

The psychological benefits of immediate reconstruction are significant. Patients undergoing immediate reconstruction often relate no feelings of physical loss. Frequently, mastectomy is recommended for early stage cancers with diffuse intraductal involvement. Reconstruction at the time of mastectomy allows these patients to resume a normal lifestyle, as quickly as possible with fewer daily reminders of their disease. When mastectomy is performed for advanced or recurrent disease, the immediate reconstruction gives the patient added confidence that the cancer may be cured.

When is delayed reconstruction appropriate?

Despite the many positive aspects of immediate breast reconstruction, certain clinical situations are best treated with delayed reconstruction. When it is uncertain whether radiation therapy will be required and the patient is a candidate for an implant reconstruction, the reconstructive procedure should be delayed until the surgical pathology is reviewed and the radiation decision is made. When radiation to the chest wall is required, the chance of achieving a cosmetically successful implant reconstruction is small, and these patients are best treated with flap reconstructions.

If the viability of the mastectomy skin flaps is questionable at the completion of the mastectomy, then it is advisable to delay the reconstruction until healing is complete. This is especially important in patients undergoing tissue expander placement, since skin necrosis and expander exposure can result when necrosis of skin flaps occurs. In patients who smoke, are diabetic, or have a collagen vascular disease, assessment of skin flap viability at the time of mastectomy may be difficult, and great care and selection must be exercised before immediate tissue expander placement. When there is either questionable pathology in the contralateral breast or when the patient is considering contralateral mastectomy, it is best to delay the reconstruction, since bilateral reconstruction is most successful when performed simultaneously. There will always be some patients who simply cannot decide whether to undergo reconstruction or what type of reconstruction to

have. These patients should be advised to defer reconstruction and be reassured that a successful reconstructive outcome is likely in the future.

What information should be reviewed with the patient prior to a decision regarding immediate reconstruction?

Often the patient is referred to the plastic surgeon immediately following the diagnosis of breast cancer and recommendation for a mastectomy. This initial consultation, at which the patient is provided with information that will help her make an educated, informed decision, is very important. The patient is often under great psychological stress and must absorb a tremendous amount of information in a very short period of time. The plastic surgeon must make the breast reconstruction information concise and complete so that the patient can make an informed decision.

If the best choice for reconstruction is to be made, several key questions must be answered prior to the mastectomy. What is the risk of cancer developing in the contralateral breast? Does the contralateral breast require biopsy to resolve the pathologic issues which would determine the need for contralateral mastectomy? These issues are important because the approach to bilateral reconstruction might be quite different from unilateral reconstruction. Is it feasible to alter the contralateral breast to obtain symmetry, or will the oncologic surgeon or mammographer object, feeling it will interfere with future monitoring? This decision may alter the technique of breast reconstruction chosen. Will postoperative chest wall radiation be required? Radiation can significantly compromise the likelihood of success with an implant reconstruction. Has the patient definitely decided upon mastectomy, or is breast conservation an alternative? When the reconstructive process is perceived as very complicated, the patient may choose breast conservation. At the initial consultation, the patient must be given all information about alternatives and expected outcome. Patients undergoing immediate breast reconstruction usually follow the referral guidance of their oncologic surgeon and rarely seek second opinions. Reviewing photographs of average as well as excellent reconstructions helps the patient understand the spectrum of surgical outcomes.

Facilitating discussion with other patients who have gone through the reconstruction process and the associated decision making is often the most helpful service one can provide. Only when all issues are addressed will the correct reconstructive decision be made. When there is significant uncertainty by either the reconstructive surgeon or the patient, reconstruction should be deferred.

WHAT ISSUES SHOULD BE CONSIDERED IN DETERMINING THE TYPE OF RECONSTRUCTION? Several factors must be considered when selecting the type of breast reconstruction to be performed. When recommending a specific reconstructive technique to the patient, the basic body anatomy, general medical condition, age, risks of contralateral disease, and patient preference as well as expectations all must be evaluated.

Anatomic considerations must include the necessity of altering the contralateral breast with reduction, mastopexy or augmentation as well as the availability of tissues at the various donor sites. Patients undergoing a long surgical procedure and recovery must be in good general health to minimize operative and postoperative morbidity. Smoking limits the success rates of certain flap techniques for breast reconstruction. A history of

diseases such as diabetes or collagen vascular disease that result in microcirculatory impairments may also compromise the success rates of certain flap techniques.

Previous radiation to the chest wall is another important variable, since any technique that involves implants has a high failure rate in radiated tissues. Flap reconstruction is more prone to complications in radiated tissues, but a satisfactory result is usually possible. Any patient with significant back problems should not undergo a TRAM flap, since weakening of the abdominal wall musculature may exacerbate existing dormant back problems. In young patients, an increased risk of contralateral breast cancer over her lifespan influences the choice of procedure, since bilateral reconstructions are best when the same technique has been used on both sides. Certain flap techniques (TRAM/DIEP flaps) cannot be done a second time if contralateral reconstruction becomes necessary. Older patients do not tolerate complex flap reconstructions as well as younger patients. The patient's expectations for achieving symmetry with a contralateral breast often make certain techniques preferable in specific situations. Ultimately, if the patient is given enough information by the reconstructive surgeon, her preference will be a large factor in technique selection. Recovery time as well as her feelings about the use of implants may be significant issues.

WHAT ARE THE TWO BASIC FORMS OF BREAST RECONSTRUCTION?

Techniques for breast reconstruction can loosely be divided into two basic categories: autologous techniques and implant techniques. Autologous, or flap procedures include DIEP flaps, TRAM flaps, latissimus dorsi flaps, gluteus maximus flaps, or lateral thigh. All have specific advantages and disadvantages. Implant procedures may be simple implant, tissue expander techniques, or latissimus dorsi flap with implant or tissue expander placement. In general, flap techniques have longer operative times, increased morbidity, increased recovery time and postoperative pain. Flap techniques are basically one stage procedures, while tissue expander procedures involve two stages. Flap techniques are true immediate reconstructions. The patient undergoing simultaneous mastectomy and reconstruction with a flap never experiences the anatomic defect resulting from mastectomy, while the patient receiving a tissue expander after a mastectomy is just starting the reconstructive process. The final result of an implant reconstruction is never as soft and pliable as an autologous tissue reconstruction.

Ultimately, all reconstructions are judged on the degree of symmetry with the contralateral breast. A patient with large ptotic breasts almost always requires reduction or mastopexy of the contralateral breast, since the limitations of available donor site tissues or the ability to expand the mastectomy site are at best limited when size and ptosis are the predominant goals. Autologous tissue reconstructions more readily allow for precise symmetry at the expense of additional scars and donor site morbidity. Despite initial concerns, patients reconstructed with flap tissue do not appear to be delayed in diagnosis of local or regional recurrence of their breast cancer.

Implant reconstructions tend to have minimal ptosis and often produce a reconstruction that assumes the shape of the implant. These limitations of implant reconstructions may require augmentation of the contralateral breast. Implants may result in interference with future mammograms, a long-term risk in the contralateral breast. In addition, the implants may develop capsular contractures, deflate, or rupture. When mastectomy flaps are thin, the implant may be palpable or rippling may be visible. The use of the latissimus dorsi

myocutaneous flap may add additional camouflage to the implant as well as increased ptosis and shaping not possible with implant reconstructions alone.

The immediate latissimus dorsi flap and implant reconstruction essentially skips the expansion phase with its inherent delay and morbidity. The latissimus dorsi is often an excellent choice when previous radiation has been administered or the patient has underlying microcirculatory problems.

TISSUE EXPANDER-IMPLANT TECHNIQUE

What are the advantages of tissue expansion implant reconstruction?

Recent trends toward more conservative mastectomies create new challenges for the reconstructive surgeon. Basic principles of reconstruction always favor the use of autologous tissues with similar color, texture and subcutaneous fat. The postmastectomy defect lacks both skin and underlying breast mound. The skin envelope must have adequate laxity to allow the breast mound to project sufficiently and remain soft in consistency. When possible, careful planning with the oncologic surgeon, at the time of the mastectomy, makes the achievement of these goals easier. The smaller mastectomy defect and the ability to begin reconstruction at the time of mastectomy makes tissue expansion a prime method to reconstruct the absent breast. The tissue expander is an ideal tool to prepare the remaining mastectomy skin to receive a permanent prosthesis.

Recent advances in tissue expander design have simplified the expansion procedure and made it more predictable and successful. Complete expansion has become easier, because with the development of textured surfaces on the expander the capsular response has been decreased, resulting in less contracture during the expansion phase. The texture also helps to prevent expander movement or migration during expansion. This allows for maximum expansion in precise areas. The introduction of an anatomic shape to the expander allows preferential expansion of the lower pole of the breast skin.

Who are appropriate candidates for tissue expander reconstruction?

In general, patients with smaller, minimally ptotic breasts, who have undergone a total mastectomy, are candidates for tissue expander reconstruction. Patients are better candidates for this technique. Patients with large, ptotic breasts will require significant modification of the contralateral breast to achieve symmetry. Furthermore, recurrence of ptosis in the larger breast may make an initial good result deteriorate over time.

Which patients are not candidates for tissue expansion reconstruction?

Patients who have inadequate soft tissue after mastectomy to cover the tissue expander are not candidates for tissue expander-implant reconstructions. The radical mastectomy patient, with thin flaps and absent pectoralis major muscle, requires the addition of soft tissue and is not a candidate for tissue expander-implant reconstruction. Other patients who have undergone extensive skin excisions with tight closure and thin flaps are also better treated with flap reconstructions. Patients who have undergone previous breast conservation surgery with radiation therapy as part of their treatment, or patients who require postoperative chest wall radiation following a mastectomy also are not good candidates for tissue expander-implant reconstructions. Radiation injury to the chest wall tissues makes adequate expansion difficult and increases the risks of expander or implant complications, such as infection, implant exposure, rib fracture or capsular contracture.

Alternative, usually autologous, reconstructive techniques are chosen for these patients. If one chooses to use tissue expansion in radiated patients, then both patient and surgeon must be prepared to abandon the technique if complications occur. A secondary plan should be available for completion of the reconstruction. Many of these cases can be successfully salvaged with a latissimus dorsi flap or other autologous reconstruction.

To achieve maximum symmetry with an implant reconstruction may require significant alteration of the contralateral breast by either mastopexy, augmentation, or reduction. These issues must be considered and discussed prior to reconstruction with the patient, oncologic surgeon and mammographer.

What issues in operative planning should be considered by the oncologic surgeon with immediate implant reconstruction?

Every effort should be made to develop healthy skin flaps, of uniform thickness, during the mastectomy. Ischemic flaps will delay healing of the incision and limit the uniform skin expansion required to achieve a good result. Very long flaps, created to preserve large amounts of native breast skin, should be avoided. Rather, the goal should be to provide enough skin to comfortably close the incision without redundancy. Traditional guidelines for skin excision should be followed, adhering to standard oncologic principles. When bilateral mastectomy is being performed, every effort should be made to perform symmetrical skin excisions. Careful preoperative discussion with the oncologic surgeon is essential to achieve good results using this technique of reconstruction.

What are the considerations in choosing the type of expander?

An anatomically shaped tissue expander with a textured surface and integrated port is desirable. Previous experience with smooth surface expanders resulted in capsular contracture in a significant number of patients, this limited full expansion and the creation of a soft, pliable skin envelope of adequate size to accept the final implant. The anatomic shape allows for preferential expansion of the lower pole skin, thus achieving adequate anterior projection in the reconstructed breast. The use of an expander with an integrated port, rather than a remote port, makes the expansion process less painful because the skin over the integrated port is usually anesthetic, while the skin over a remote port has sensibility. Complications of port malfunction are also less likely with the integrated port.

The primary consideration when choosing the size of the tissue expander to be used is the width of the contralateral breast. One should always choose a tissue expander at least as wide as the contralateral breast. Smaller sized expanders are used in patients with narrow breasts, and larger sizes are used in patients with wider breasts. When bilateral mastectomy has been, or is being performed, the size of the tissue expander is based on the preexisting base width, unless the patient prefers to be smaller or larger. This discussion is part of the preoperative consultation with the patient.

What postoperative measures are taken with tissue expansion reconstruction?

The patient is usually sent home with the drains in place, and the drains are removed in the office in 5-7 days. Repeated aspirations of postoperative seromas are to be avoided whenever possible, since this will increase the risk of infection and possible expander perforation. The only seromas aspirated are axillary seromas following immediate reconstruction. All patients receive one week of antibiotics. Limited use of the ipsilateral

arm is allowed during the first two weeks, and all range of motion exercises are delayed for this period of time. Skin sutures are removed in two weeks and expansion is usually begun at that time.

What guidelines are followed for the expansion phase?

The goals of expansion are to achieve an adequate skin envelope for the permanent implant. This will result in a soft, pliable, natural appearing breast. The amount of over-expansion must be adjusted based upon the thickness of the skin flaps and the type of implant that will ultimately be used. All implants may ripple, and this may be visible through the skin. The tendency for rippling is greater with saline implants, especially when placed under thin flaps. When saline implants are used and the flaps are thick, over-expansion by 25-30% is recommended. This allows for trimming of excess skin at the exchange procedure, potentially creating a better shaped breast in the final reconstruction. When the flaps are thin, over-expansion is kept to a minimum. Expansion will tend to thin the flaps further and accentuate visible rippling. In general, silicone implants have less rippling than saline implants, but the same general principles for over expansion apply to silicone implants.

In the immediate setting, when chemotherapy is being given, the exchange procedure is not done until the chemotherapy has been completed and the patient's laboratory values have returned to normal. In these cases, the final stages of expansion are delayed until chemotherapy is nearly completed. If an expander has been placed and the patient must receive chest wall radiation, the expander is usually fully expanded before radiation treatments begin. The patient's local response to radiation is followed closely. Removal of saline should be considered if the local reaction is severe the health of the expanded skin is jeopardized.

In most circumstances, expansion is done weekly in the office utilizing sterile technique and a 23 gauge butterfly needle. The patient is allowed to remain fully expanded for one month prior to the exchange procedure.

How is the appropriate implant selected for the exchange procedure?

The first consideration in planning the exchange procedure is choosing the appropriate implant. Available implants are either round or anatomical in shape. Anatomical implants are available in numerous shapes that vary in width, height and projection. Evaluation of the contralateral breast is key to choosing an implant for exchange. When previous modification of the contralateral breast has been performed by reduction or mastopexy, the exchange procedure should be done only after enough time has elapsed to allow the modified breast to settle into a stable position. If modification of the normal breast is planned at the time of implant placement, its final shape and volume must be predicted at this stage to facilitate implant selection. The goals at placement of the permanent implant are to match the width, height, projection and volume of the contralateral breast. A general idea of the volume can be estimated by knowing the volume in the expander that matched the volume of the existing breast. Width, height and projection are measured and the appropriate implant selected from available charts. One should always have many different sized implants available at the exchange procedure. Saline implants look best when they are slightly overfilled, thus minimizing rippling. An implant with a posterior fill valve is preferred because anterior valves are often palpable or visible through the

skin. Often the asymmetric orientation of an anatomical implant will help match the contralateral breast shape.

LATISSIMUS DORSI MYOCUTANEOUS FLAP RECONSTRUCTION

Initial attempts to reconstruct the radical mastectomy defect using silicone implants were often unsuccessful due to the absent pectoralis major muscle and thin skin. In 1976, the pedicled latissimus dorsi musculocutaneous flap was used for the treatment of radiation necrosis of the chest wall. In 1977, the latissimus dorsi was utilized as an island pedicle flap for breast reconstruction.[1] The large, fan shaped muscle could be completely transposed anteriorly to replace the absent pectoralis major muscle and recreate the anterior axillary fold, as well as provide a well vascularized muscle and skin envelope to receive an implant. The skin island, when properly designed, could replace the skin removed at mastectomy. Initially, a smooth silicone implant was placed under the latissimus dorsi muscle, and significant incidence of capsular contracture resulted. With the development of the transverse rectus abdominis myocutaneous flap (TRAM), which did not require an implant, the latissimus dorsi flap became a secondary reconstructive choice. The development of textured implants, as well as expanders, has decreased the incidence of capsular contracture significantly.[2] In selected cases, when adequate subcutaneous fat is available over the latissimus dorsi muscle, no implant is required and a total autologous breast reconstruction is possible.[3] Despite the trend towards less radical cancer surgery, the latissimus dorsi myocutaneous flap still plays a significant role in breast reconstruction.

Who is a candidate for latissimus dorsi flap reconstruction?

In patients who require the addition of autologous tissue to achieve breast symmetry and who are not good candidates for TRAM flap reconstruction, the latissimus dorsi flap can be very useful. The patient who has a large skin requirement at the mastectomy site as well as ptosis in the contralateral breast is usually best treated by autologous tissue techniques rather than by tissue expander and implant techniques. When the TRAM flap, or other autologous tissue donor sites, is not an option because of lack of tissue, previous surgery, smoking, obesity, diabetes mellitus, or collagen vascular disease, then the latissimus dorsi flap can be reliably used. The blood supply to the latissimus dorsi flap is excellent, even in patients with a compromised microcirculation. It is rare to have total or partial loss of a latissimus dorsi flap. When a latissimus dorsi flap will achieve symmetry with a contralateral ptotic breast without requiring mastopexy or reduction, some patients will choose this flap over simpler techniques which would require significant alteration of the normal breast.

What are the advantages of latissimus dorsi flap reconstructions?

The latissimus dorsi flap and implant offers several advantages over tissue expander-implant techniques. The latissimus dorsi skin component replaces the skin removed at mastectomy and avoids the morbidity of tissue expansion. The latissimus dorsi flap provides a true, immediate breast reconstruction completed in one stage at the time of mastectomy. The latissimus dorsi muscle provides an envelope of tissue under the mastectomy skin. Ripples are less visible when a latissimus dorsi flap is utilized. This technique can often salvage a cosmetically poor tissue expander/implant reconstruction.

When a tissue expander has been placed and chest wall radiation is required postoperatively, adequate expansion is often difficult to achieve. In these cases, the addition of a latissimus dorsi flap can salvage an reasonable cosmetic result. Patients who have undergone breast conservation and develop tumor recurrence require total mastectomy. If the TRAM flap donor site is not available, the latissimus dorsi flap is a good second choice.

What are the preoperative considerations in planning a latissimus dorsi flap reconstruction?

A complete evaluation of the reconstructive requirements of the chest wall is an essential part of the planning of all types of breast reconstruction. It is especially important when a latissimus dorsi myocutaneous flap is being used. The volume of autologous tissue available with this flap is limited, and its positioning on the chest wall is critical to achieving a good cosmetic result.

The upper chest wall contour is primarily dependent upon the adequacy of the pectoralis major muscle. In the radical mastectomy patient, the pectoralis major muscle is absent, but even in the modified radical mastectomy patient, pectoralis major atrophy can occur secondary to enervation during axillary dissection. Re-establishment of a symmetric upper chest wall contour takes high priority and may require de-epithelialization and subcutaneous placement of the skin flap paddle. Anterior axillary fold contour may need reconstruction. Transposition of the entire latissimus dorsi muscle with anterior positioning of its insertion enables reconstruction of the anterior axillary fold. The location and orientation of the mastectomy scar should be noted. The preferred final position of the skin island is in the lower lateral aspect of the reconstructed breast. High incisions and vertical incisions are best left alone when planning the flap inset. In these cases, a new incision should be planned so that an inferolateral inset is possible. When the chest wall has been radiated, the skin requirements may be significantly greater than expected preoperatively. In situations when the skin requirements are greater than can be provided by the latissimus dorsi skin island, a tissue expander, rather than an implant, should be placed at the time of flap transfer.

Evaluation of the latissimus dorsi muscle, subcutaneous tissue, and skin laxity is important. When the examination reveals that the latissimus dorsi muscle has been denervated at the time of axillary dissection, the thoracodorsal vessels have most likely been divided. Transfer of the musculocutaneous unit must then be based on the serratus branch of the thoracodorsal vessels, which will perfuse the flap via the intercostal vessels. The need to base the flap on serratus vessels may limit the arc of rotation of the muscle and the ability to transfer the entire muscle anteriorly. This will limit the amount of tissue available for reconstruction, and an alternative reconstruction might be considered. The vascularity of the flap may also be significantly less when transferred on these secondary vessels. If a patient is a smoker, diabetic, or has any other systemic microcirculatory disorders, partial or complete flap loss is more likely.

The laxity of the skin on the back is quite variable, as is the orientation of the greatest skin-laxity axis. When designing the skin island, these factors must be considered. Some patients have large amounts of subcutaneous fat, either just below the posterior axillary fold or lower on the back. Incorporating the subcutaneous fat excess under the skin island can add a large amount of autologous tissue to the flap and simplify the reconstruction.

Symmetry procedures can either be done at the time of the latissimus dorsi flap or at a later date. Delaying contralateral breast surgery improves the chance of obtaining optimal symmetry. This is especially true if a tissue expander has been placed under the latissimus dorsi flap.

What are the guidelines for postoperative management?

A broad-spectrum antibiotic is begun in the operating room and continued for one week postoperatively. Suction drains are removed when 24 hour drainage is less than 50 cc. The anterior chest drain can usually be removed after 48 hours. Often the posterior donor site drains must remain in place for 10 days or more, and patients are instructed to care for the drains prior to discharge. Despite this regimen, approximately 20-50% of patients will develop a seroma at the donor site. If the seroma is small, it will usually be self-limited and resolve over several weeks. When it is larger, repeated aspirations may be required. When the muscle insertion has not been transferred anteriorly, range of motion exercises are begun two weeks after surgery and full activity is allowed after six weeks. When a seroma occurs, range of motion should be limited until resolution of the seroma. When the insertion of the latissimus dorsi has been reattached anteriorly, abduction of the arm is limited for six weeks, allowing the suture line to heal. When a tissue expander has been placed under the latissimus dorsi muscle, expansion is usually begun one week postoperatively, and full expansion is achieved as rapidly as possible. Following one month of full expansion, an exchange of the tissue expander for a permanent or adjustable textured implant and any symmetry procedure on the contralateral breast is performed. Nipple reconstruction is deferred for six weeks to three months to allow final contour of both the reconstruction and the contralateral breast to stabilize.

UNILATERAL BREAST RECONSTRUCTION WITH THE TRAM/DIEP FLAP

The transverse rectus abdominus myocutaneous flap (TRAM) or deep inferior epigastric perforator flap (DIEP) allows reconstruction of the breast without prosthetic implants. Use of these flaps requires a longer, more complex, surgical procedure, with the occasional need for blood transfusions. These flaps can provide the natural ptosis that cannot often be duplicated with a breast implant, however. Autologous tissue has tactile sensation more like breast tissue. The flap develops sensory return via nerve ingrowth into the flap from the mastectomy bed. Excellent symmetry can more typically be achieved with a TRAM/DIEP flap reconstruction.

The TRAM operation can be performed as a microvascular free flap, a single pedicle flap utilizing one rectus muscle, or a double pedicle flap utilizing both rectus muscles. The DIEP flap is always performed as a microvascular free flap. The choice of flap is based on the preference of the individual surgeon, as well as on the specific patient's situation. Patients who are smokers or patients who require a large volume of tissue may benefit from a microvascular free flap. A double pedicle TRAM flap may also be used in these patients. Unfortunately, double pedicle flaps require sacrifice of both rectus abdominus muscles. This may result in significant abdominal wall weakness which may be unacceptable to some patients. Prior right upper quadrant subcostal type incisions will prevent use of right rectus abdominus pedicled TRAM flaps. This would be an indication for use of either a left rectus muscle pedicle TRAM flap or a microvascular free flap such as a DIEP.

What are the risk factors for successful TRAM/DIEP flap reconstruction?

Several risk factors increase the failure rate of the TRAM/DIEP flap. Obesity, particularly when the patient is greater than 25% over the ideal body weight, is associated with increased TRAM/DIEP flap complications. Patients who smoke are at increased risk for small vessel disease and, therefore, increased risk for tissue necrosis. The risk increases with the amount and length of smoking. Diabetes mellitus may also be associated with an increased risk of flap necrosis. Abdominal scars that disrupt the periumbilical perforators, are an absolute contraindication to any TRAM or DIEP flap, since there is no way that the flap can survive without perforators, no matter which pedicle is utilized. Obviously, major systemic illnesses, such as severe cardiac disease, chronic pulmonary disease, and hypertension are relative contraindications to TRAM/DIEP flap reconstruction based on the severity of these processes. All patients must be assessed and carefully evaluated prior to the consideration for surgery.

Although blood transfusion with the TRAM/DIEP flap is usually not necessary, patients should be cross-matched and prepared for transfusion. Whenever possible, autologous blood should be available. This may not be possible in immediate reconstructions since the patient frequently desires to have surgery very quickly. Donor-related blood should be considered in situations where autologous blood is not available.

The TRAM/DIEP flap is an operation that can only be performed once. Therefore, patients who are at high risk for bilateral breast cancer should be advised that unilateral reconstruction with a TRAM/DIEP flap will preclude performance of the operation on the other side, at a later date, if needed.

What are the preoperative considerations in planning a TRAM/DIEP flap reconstruction?

The extent of the mastectomy wound varies from patient to patient depending upon the extent of soft tissue resection that is performed by the oncologic surgeon. To achieve a symmetrical soft tissue volume the skin that is missing must be replaced in its entirety, along with, the missing soft tissue volume. When possible, skin-sparing mastectomy improves the aesthetic result of the reconstruction. Singletary has shown that the regional recurrence after skin-sparing mastectomy is a function of the biology of the tumor and the stage of the disease and is not affected by the use of immediate reconstruction or skin-sparing mastectomy.

In cases of immediate reconstruction, the skin that is being excised from the breast can be measured and the skin paddle can be copied exactly on the TRAM/DIEP flap. The weight of the soft tissue that is required for reconstruction can be estimated by weighing the mastectomy specimen. The dimensions of the mastectomy specimen can also be measured. All data that is available should be utilized to try to match the defect that is created. The skin replacement must be as close to exact as possible. If an inappropriate amount of skin is present in the medial-lateral dimension, the breast will appear too wide or too narrow. If the amount of skin in the superior-inferior dimension is wrong, the breast will either have too much or too little ptosis. It is always helpful if the oncologic surgeon saves as much skin as possible in the medial portion of the breast. This will allow preservation of the cleavage fold.

After the defect and the chest wall are assessed, the abdomen must be evaluated. The location of scars, the amount of fat, and the abdominal wall strength need to be noted. Pedicle TRAM flap is not possible if the patient has had bilateral subcostal incisions. A unilateral subcostal scar will prevent the use of a pedicle from that side. The presence of a unilateral subcostal scar does not preclude the use of the muscle on the other side. Patients who have undergone abdominoplasty surgery are not candidates for the TRAM/DIEP flap.

The amount of fat available in the abdomen must be evaluated. The patient should be asked to tighten the abdominal wall to assess how much of the abdominal fat is extra-fascial. The amount of fat present on one side of the abdomen must be estimated. Is this fat enough to reconstruct the breast with a single pedicle? If there is not enough fat available on one side of the abdomen, consideration must be made for a bipedicle TRAM flap reconstruction or a microvascular free flap. The strength of the abdominal wall must be assessed. If the abdominal wall is weak and lax particularly below the arcuate line, then the TRAM flap should be placed higher on the abdomen. In addition, the weaker the abdomen, the more likely that the patient will require closure of the wound with prosthetic material after a TRAM flap. DIEP flaps never require prosthetic material. All TRAM patients should be told about the possibility that prosthetic material may be used for abdominal closure. Many patients who are undergoing TRAM flap reconstruction expect a totally autologous reconstruction. These patients should be aware that prosthetic material is frequently used to close the abdomen.

Are all abdominal scars a contraindication to TRAM flap reconstruction?

If bilateral subcostal scars are present, then a microvascular free TRAM flap or DIEP flap should be considered. Midline scars are not a contraindication to the TRAM flap. The presence of a midline scar will make the tissue contralateral to the pedicle unusable for the reconstruction. If more tissue than available on one side of the abdomen is needed for breast reconstruction, then a microvascular free TRAM or DIEP flap should be considered. Appendectomy scars are usually not a contraindication to TRAM flap breast reconstruction. The position and length of the appendectomy scars vary among patients. For right breast reconstruction, using a TRAM flap with a left rectus abdominus pedicle, there is usually sufficient tissue for the reconstruction with all tissue lateral to the appendectomy scar discarded. For left breast reconstruction there occasionally are problems with the right rectus abdominus pedicle after appendectomy. One might consider using a left rectus abdominus pedicle. If a right rectus abdominus pedicle is utilized, the appendectomy scar must be very lateral. All tissue lateral to the appendectomy scar must be considered to be unreliable. A bipedicle TRAM flap may be indicated in this situation.

BILATERAL BREAST RECONSTRUCTION WITH THE PEDICLED TRAM FLAP

The TRAM flap is an excellent choice for bilateral breast reconstruction. Frequently, in unilateral reconstruction, a significant amount of flap tissue is discarded because it is either not well vascularized or not needed in the reconstruction. The bilateral TRAM flap reconstruction offers tissue that is often sufficient in size to make two breasts. If the

patient lacks a large abdominal panniculus, the breast size may be smaller than prior to mastectomy. The bilateral TRAM flap uses both rectus abdominus muscles and produces significantly more abdominal weakness than a unilateral TRAM flap.

What are the preoperative considerations in immediate bilateral TRAM RECONSTRUCTION?

As in unilateral breast reconstruction, the reconstructive surgeon must plan the surgical incisions with the oncologic surgeon at the beginning of the case. Symmetry of the incisions, where possible, will result in a better reconstruction. This is not always possible based on the locations of the primary lesions. It is better to include more skin in the mastectomy specimens and have symmetrical defects than to minimize the extent of the skin incisions and have asymmetric defects. If possible, symmetric skin-sparing incisions are desirable.

What are the preoperative considerations in delayed bilateral TRAM RECONSTRUCTION?

When evaluating a patient for bilateral reconstruction after mastectomies, one must take note of the locations of the incisions. In addition, some patients have had a modified radical mastectomy on one side and a radical mastectomy on the other side. Even if the same mastectomy operation was performed on both sides, the volume requirements are sometimes different. All factors must be noted in the initial consultation prior to the onset of reconstruction. It is the goal of the reconstructive surgeon to make both breasts as symmetrical as possible. If more tissue is needed on one side for reconstruction, the TRAM flap can be asymmetrically split in such a way that this is accomplished.

FREE FLAP BREAST RECONSTRUCTION

FREE TRAM FLAP

The free microvascular TRAM flap offers improved flap blood supply and less abdominal wall trauma than the single pedicle TRAM flap. Abdominal wall function improves faster after a free TRAM flap than after a single pedicle TRAM flap, but at six months postoperative the difference becomes insignificant. The free TRAM flap is ideally suited for immediate breast reconstruction when the subscapular trunk is exposed during the mastectomy and easily available for microvascular anastomosis.

The disadvantages of the free TRAM flap are the requirement that the surgeon be proficient in microsurgery and the rare but possible risk of total flap loss. Pedicle TRAM is almost never complicated by total flap loss but is more frequently complicated by fat necrosis. The cost of performing free TRAM flaps is not significantly higher then pedicled flaps in experienced hands.

What are the contraindications to free TRAM flap reconstruction?

While any kind of TRAM flap is relatively contraindicated in patients who smoke, are obese, or have severe medical problems, the contraindications are less for the free TRAM flap which is better vascularized and less prone to tissue loss. Smokers are asked to stop smoking for at least two weeks prior to surgery and for 4 to 6 weeks afterward. In patients who require a large amount of tissue for breast reconstruction or who have had chest wall irradiation, the free TRAM flap or DIEP is the best option.

What are the preoperative considerations with free TRAM flap reconstruction?

Most free TRAM flaps are performed for immediate reconstruction. The incisions for the mastectomy are planned with the oncologic surgeon. While oncologic considerations always take precedence over aesthetic ideals, an effort should be made to spare as much skin as is possible. The flap can either be elevated simultaneously with the mastectomy or afterward depending on the level of comfort the oncologic surgeon and the reconstructive surgeon have with simultaneous operating room logistics. The operating room logistics and patient positioning is similar to that for a pedicle TRAM flap.

How is the patient managed postoperatively?

Postoperatively the flap is minimally dressed and is monitored with visual inspection, temperature monitoring, and/or doppler ultrasound. The patient is allowed out of bed on the first postoperative day. Arm motion is limited and abduction is discouraged. One aspirin is given daily for 30 days. No other anticoagulation is used. The patient is allowed to begin arm exercises 2 to 3 weeks postoperatively. Abdominal exercise is limited for 2 months.

DIEP FLAPS

The most common method of breast reconstruction using a patient's own tissues (as opposed to breast implants) has been TRAM flaps. A TRAM flap involves the surgeon removing tissue (skin, underlying fatty tissues, and muscle) from the abdomen and using it to create the new breast. The tissue needs a blood supply to keep it viable, so the surgeon has to harvest the blood vessels that run through the underlying muscle to the abdominal wall fat and skin. Although what is really needed to form the new breast is the skin and underlying fatty tissues, the blood vessels supplying those tissues go through the muscle, and that is the reason the muscle is also taken. Although TRAMs are highly successful and still a very good option for many patients, there are a few disadvantages to a TRAM flap. Because the abdominal muscles are cut and a portion removed, patients occasionally have abdominal wall weakness. In addition, they are also at a small risk for abdominal wall hernias.

What is a DIEP flap?

A DIEP flap is a microsurgical technique that can be an improvement over the TRAM flap in selected patients. When a DIEP flap is harvested, the skin and underlying fatty tissues from the abdomen are removed, but the muscle and abdominal wall fascia are preserved and left in place. In a DIEP flap, the surgeon uses microsurgical dissection to define perforator vessels without taking any muscle.

What are the advantages of a DIEP flap?

Because this approach leaves the muscle wall and its overlying fascia intact, there is less risk of abdominal wall weakness and hernia. In addition, patients tend to have less discomfort following DIEP surgery as compared to a free TRAM flap. Because of the

reduced pain and fact that the muscle wall remains intact, patients are often able to get back to their normal daily routines more quickly than after a TRAM flap reconstruction. Patients undergoing a DIEP flap have essentially the same scar as those undergoing a TRAM flap.

WHAT ARE THE CONTRAINDICATIONS FOR A DIEP FLAP?

As with any surgical procedure, there are potential disadvantages with a DIEP flap. Because it is a more complex procedure, the DIEP flap takes longer so the patient's anesthesia time is also longer. If a patient has previously had abdominal surgery, or if the patient does not have enough extra skin and underlying fatty tissues in the abdomen, the patient may not be a candidate for this type of procedure. Also, because of the complexity of this procedure, not all surgeons are experienced at performing a DIEP flap. Determining whether a patient is a candidate for a DIEP flap is something the surgeon must do on a case-by-case basis. There are some conditions which may possibly prevent a patient from being a candidate for a DIEP. These include: Insulin-dependent diabetes, significant cardiac or pulmonary diseases/conditions, obesity, advanced age, smoking, previous abdominoplasty ("tummy tuck"), or previous abdominal liposuction. As a general rule, most patients who qualify for a TRAM flap will probably qualify for a DIEP flap, with some exceptions due to the increased length of surgery. Previous c-sections, hysterectomies, and appendectomies do not normally interfere with a patient qualifying for a DIEP flap.

WHAT IS THE SIEA FLAP VARIATION?

An SIEA flap is essentially a variation on the DIEP flap. The difference is in which blood vessels are utilized. The decision as to which blood vessels will be used is one which is made intraoperatively by the surgeon, based upon the patient's own anatomy. For the vast majority of patients, the DIEP flap is the best alternative. However, in the hands of a surgeon who is highly experienced with perforator flaps, it may be possible to do the SIEA flap.

GLUTEAL FREE FLAPS

The superior gluteal flap was first reported by Fujino and then popularized by Shaw.[,] This flap is typically considered a secondary or tertiary choice for free tissue reconstruction of the breast because of the increased operative time, complexity, and morbidity associated with the procedure. The patient considered for free gluteus microvascular transfer is usually not a candidate for TRAM flap (insufficient tissue or abdominal scars) but desires an autologous breast reconstruction.

What are the advantages and disadvantages of a superior gluteal flap?

The advantages of the superior gluteal free flap include abundant tissue for reconstruction, inconspicuous donor site, and minimal functional loss. Shaw has

demonstrated the spontaneous restoration of sensation in the flap without nerve reconstruction.

The disadvantages of the superior gluteal free flap include the risk of total flap loss and increased operative time common to all free flap procedures. In addition, the superior gluteal flap is technically much more difficult to harvest than the TRAM flap, and the recipient vessel dissection (usually internal mammary) is more difficult than dissection of the thoracodorsal vessels.

What are the advantages of an inferior gluteal free flap?

The inferior gluteal free flap offers the following advantages over the superior gluteal free flap: A longer pedicle, greater volume of tissue, and a lower incision that may be more inconspicuous. The main disadvantages of the inferior gluteal flap are exposure of the inferior gluteal nerve, the motor nerve to the gluteus maximus muscle, and the sciatic nerve in the dissection.' Postoperatively there is some discomfort with sitting related to the scar in the inferior gluteal fold. The longer pedicle allows the use of the thoracodorsal vessels for microvascular anastomosis. In addition, the pedicle in the inferior gluteal flap is located more toward the edge of the flap when compared to the superior gluteal flap. This allows more straightforward microvascular anastomosis

How is the patient managed postoperatively?

The postoperative care of the patient with a gluteal free flap involves maintaining the hip in extension over the first few postoperative days. The patient is gradually allowed to sit in a chair and then to ambulate. The patient is usually discharged 5 to 7 days after surgery. There is minimal functional deficit, since only a small portion of the muscle is sacrificed. Seromas are the most common donor site complication, and either resolve spontaneously or require aspiration.

NIPPLE AREOLA RECONSTRUCTION

Breast mound reconstruction improves the patient's body image after mastectomy. Nipple-areola reconstruction allows closer symmetry and increases patient acceptance of the reconstructed breast. The nipple-areola is the initial focus of attention when visualizing the breast. In cases where the mound reconstruction is slightly less than optimal, an excellent nipple-areola reconstruction may make the reconstructed breast look much more like the normal breast. Wellisch found that patients who had nipple-areola reconstruction had greater satisfaction than those who did not. The nipple-areola reconstruction should be considered a normal step in the process of total breast reconstruction. The patient should be aware of all stages in the reconstructive process prior to the initial procedure. If this is done, nipple-areola reconstruction will be accepted as a logical step in the reconstructive process.

What are the anatomical considerations in nipple-areola reconstruction?

The nipple-areola should be located on the most prominent portion of the breast. This will be the first area seen when the reconstructed breast is visualized. The nipple should point slightly upward and outward. There is significant variation in the shape and size of the nipple-areola complex. The average nipple projects 3 to 7 mm. The average areola diameter is 35-45 mm. The surface of the areola varies from smooth to rough. The number and prominence of the Montgomery glands is variable. The goal in nipple-areola

reconstruction is to match the unoperated, normal breast. The nipple position should be marked with the patient in the upright position. Ideally, the patient should be sitting or standing in front of a mirror and participate actively in the planning process.

What are the choices for nipple reconstruction?

The most realistic nipple reconstruction is from the contralateral nipple. This is the only technique that can perfectly match the color of the normal nipple. The areola may be tattooed at a later date. Unfortunately, the nipple is a sensitive donor site. This is particularly true in the mastectomy patient who only has one nipple and for whom nipple sensibility is of sexual importance. The shape of the contralateral nipple is very important in the decision making process. There must be enough nipple available to remove approximately 50% of the donor nipple and result in normal-appearing donor and recipient nipples. Aside from oncologic concerns, most patients reject the normal nipple as a donor site for nipple reconstruction.

Local flaps are reliable donor tissues that are accepted by most patients. These can be performed with or without skin graft reconstruction of the areola. Skin graft reconstruction of the areola may be performed using axillary or abdominal dogears if available. Labia donor sites are avoided due to increased patient morbidity. In general, skin grafts are avoided if a new scar needs to be created to harvest the graft. If a skin graft is to be used for areola reconstruction, and no previous incision site is available for graft harvest, the groin is utilized.

Tattooing may be used to match the color of the contralateral areola.[”] This is a particularly good method in patients who have smooth areolas. Patients with coarse areolas will do better with grafts. Tattooing may still be required to match the color.

What is the Skate-type flap?

The Skate-type flap raises a local flap from the breast mound that is wrapped upon itself to produce a nipple. The donor site will require skin graft reconstruction.

When is a local flap without areola skin graft indicated?

In patients who either are not good candidates for skin graft areola reconstruction or who do not want additional scars associated with skin graft harvest, a local flap and areola tattooing is a good option for nipple areola reconstruction.[’] The local flap is raised for nipple reconstruction, and the donor sites are closed primarily without the need for skin grafts.

What is the advantage of nipple-areola tattooing?

Areola tattooing offers several advantages over skin grafts. There is no donor site. The color can be controlled and modified with time. The nipple can be made darker than the areola. The procedure can be performed in the office with minimal anesthesia and no sedation. When a skin graft is present, tattooing can improve the nipple color even if the graft is the appropriate color. The graft color also may be improved with tattooing. Tattooing may also camouflage poor take of a graft or a shape of a graft that is not optimal. The tattoo color should probably be made slightly darker than the normal nipple-areola to allow for normal fading. Nipple-areola tattooing is usually performed after healing is complete.

SYMMETRY PROCEDURES

When choosing a method of breast reconstruction, it is often possible to select a technique which will closely match the contralateral breast in size and shape. Other times, the method chosen will require alteration of the contralateral breast to achieve symmetry. Some patients may even request surgery on the normal breast for either cosmetic or functional reasons. In patients with very large breasts, mammograms following breast reduction surgery will be easier to interpret. The timing of the symmetry procedure and the technique chosen should not interfere with either the patient's cancer treatment or future monitoring of the contralateral breast.

Available techniques include augmentation, reduction, mastopexy, or a combination of these techniques. Not only is the selection of technique important, but its timing is critical to achieving the best cosmetic results.

What are the potential problems of augmentation?

Augmentation will always interfere with future mammograms, making it difficult to visualize all of the breast tissue when an underlying implant is present. When the implant is small, placed subpectorally, and remains soft, the degree of mammographic distortion is minimal. The present use of textured saline implants has significantly reduced the incidence of capsular contracture and its subsequent firmness of the breast. Usually augmentation is useful in small breasted women who have undergone implant reconstruction and need additional upper breast fullness in the normal breast to achieve symmetry. Studies have documented the interference an implant can cause to proper mammographic interpretation. Most often the implants have been large silicone implants placed in a subglandular position with the expected 30-40% incidence of capsular contracture and subsequent hardening of the breast. This makes mammography both difficult and painful to perform. Often, several additional views are required to maximize parenchymal visualization. Long-standing implants can develop calcifications in the surrounding capsule which can also interfere with mammographic interpretation. When augmentation is being considered, carefully documented consultations with the oncologic surgeon and mammographer are important. Augmentation is best performed at the time of final implant placement to achieve best symmetry.

When is breast reduction indicated?

Breast reduction is most often required when patients have breasts larger than a C cup. It is extremely difficult to achieve symmetry in these large, usually ptotic, breasts by any reconstructive technique. When tissue expansion is chosen, the degree of expansion required will often result in extreme thinning of the overlying skin and sufficient ptosis is usually impossible to attain. In the ptotic patient, autologous tissue reconstructive techniques are preferable, assuming there is adequate donor site tissue available. Breast reduction is best performed at the time of flap reconstruction or tissue expander placement, especially in the delayed setting. Over several months, the reduced breast will develop ptosis, allowing for an accurate implant placement when a tissue expander has been placed. Breast reduction techniques all result in some internal breast scarring post-operatively. These mammographic changes are well understood and do not interfere with interpretation. When breast reduction is performed, it is important to choose a technique which has a low risk for fat necrosis. When fat necrosis occurs within the breast, it can

pose diagnostic problems, usually requiring biopsy. In selected cases, free nipple graft techniques are preferable to pedicle techniques. This technique results in the lowest risk for fat necrosis post-operatively. The long term, stable contour achieved with free nipple graft techniques is also preferable in very large breasted older women. Free nipple graft techniques also allow for removal of all subareolar ductal tissue, theoretically potentially reducing the possible development of breast cancer. Liposuction is avoided in breast reduction due to potential distortion of the internal architecture of the breast, which may make future mammographic interpretation more difficult.

When is mastopexy indicated?

Mastopexy is often required when significant ptosis exists in the contralateral breast and symmetry is the goal of reconstruction. Mastopexy, similar to breast reduction, is best performed at the time of the initial reconstructive procedure since some recurrence of ptosis is common over six months to one year post-operatively. Available mastopexy procedures either reshape the skin or internally reshape the breast mound. Internal architectural distortion should be minimized in these patients. It is best to avoid mastopexy techniques which extensively reshape the breast gland. In general, long term results have been very similar for both internal reshaping procedures and dermal procedures.

When symmetry procedures are necessary, all issues must be discussed with the patient and other treating physicians. The need for contralateral breast surgery may alter the choice of technique chosen for breast reconstruction.

BREAST RECONSTRUCTION AFTER BREAST CONSERVATION SURGERY AND RADIATION THERAPY

Increasingly, segmental excision and radiation therapy has become the established treatment for many patients with breast cancer. The aesthetic result after breast conservation surgery is affected by the extent of surgical resection of the tumor, the location of the tumor, and the orientation of the skin incisions[,]. An unsatisfactory aesthetic result is related most commonly to poorly designed skin and parenchymal resections and the failure to reapproximate breast tissue when closing. Significant resection (quadrantectomy) is more likely to result in aesthetic problems than more limited segmental excisions. The size of the breast compared to the size of the excision is critical in determining the likelihood of distortion. The larger the excision relative to the breast size, the more likely there will be cosmetic problems.

Radiation therapy often results in tissue erythema and edema that is followed with time by fibrosis, contracture, and telangiectasia formation. The decreased vascularity of the radiated tissue may result in fat necrosis and diffuse calcification. The breast may develop retraction and contracture that superiorly dislocates the breast relative to the chest wall.

Berrino noted an incidence of unsatisfactory outcomes after lumpectomy and radiation therapy of 16%-22%. He developed a classification system to describe the various types of deformity that occur after breast conservation and radiotherapy (Figure 27). The most difficult problem was cutaneous parenchymal deficiency with or without subcutaneous tissue loss.

How can deformities in the conserved breast be treated? Minimal deformities may be treated with local flaps, scar release, or tissue rearrangement. More extensive defects require release of all scar contracture and replacement with new tissue. The risk of locally recurrent cancer in patients treated with breast conservation surgery and radiation therapy has been reported as high as 10-20% in ten years. Any reconstructive technique that might interfere with surveillance of the breast is unacceptable. The use of breast prostheses could potentially obscure the visualization of small lesions mammographically. Even with specialized mammographic techniques, portions of the breast are likely to be missed.

Myocutaneous flaps will provide sufficient tissue to correct almost any tissue defect. Slavin reports that these tissues do not compromise mammographic interpretation. The muscle flap tissue becomes fibrofatty as soon as about six months after surgery and eventually becomes radiolucent. Adjacent breast tissues are not concealed or obscured mammographically. In addition, the myocutaneous flap tissues are well vascularized and improve blood supply to the surrounding tissues. This produces a less dense breast than in radiated breast tissue without muscle flap augmentation. The flap reconstruction of the breast should be delayed for 2 to 3 years after the surgical procedure until the erythema, edema, fibrosis, and contracture have stabilized.

The majority of defects after lumpectomy or quadrantectomy and radiation therapy are easily treated with latissimus dorsi myocutaneous flaps. This flap is well tolerated and has minimal donor site morbidity. The rectus abdominus myocutaneous flap is reserved for larger defects. The rectus abdominus flap donor site is associated with more donor site morbidity than the latissimus dorsi. In addition, if there is a breast cancer recurrence, the rectus abdominus will not be available for salvage reconstruction.

At the time of the reconstruction, the breast tissue must be assessed. This consists of evaluating the missing cutaneous component, the parenchymal volume loss, and the nipple malposition. The skin loss usually is greater than expected due to shrinkage from the radiation therapy. The flap skin island should be made slightly larger than the anticipated defect. In addition, there is likely to be some muscle atrophy, and the overall flap volume should be slightly larger than appears to be needed.

PSYCHOLOGICAL IMPACT OF BREAST RECONSTRUCTION

Today, almost all women with breast cancer are likely to be offered either breast conservation surgery or mastectomy and reconstruction. The options for reconstruction have increased as the surgery for breast cancer has decreased. Most patients have multiple options available to reconstruct the breast. The gross distortion associated with the radical mastectomy is very rare. The vast majority of patients who choose breast reconstruction are satisfied with the surgery.

Various studies have shown that up to one third of patients who undergo mastectomy have significant emotional distress and sexual dysfunction. Clifford, in study of women undergoing delayed breast reconstruction, showed that women who sought reconstruction were exhibiting positive coping and assertive, effective problem solving behavior. Teimourian and Adham showed that reconstruction was like a "reverse mastectomy" and neutralized the destructive effect of the loss of the breast. There is no dispute that breast reconstruction is beneficial to the patient. In the early days of breast reconstruction, the

timing of the reconstruction (immediate vs. delayed) was of some dispute. The earlier advocates of breast reconstruction felt that the patient should have lived through the defect created by the mastectomy and the use of prosthesis prior to reconstruction. The patient would value the reconstruction more after having to deal with the ablation. In addition, there was a fear that the reconstruction would delay detection of recurrence of the breast cancer. Dowden helped allay these fears that the reconstruction adversely affected the outcome after recurrence. Johnson showed that the outcome in breast cancer patients depended on the biology of the tumor and not on the presence of a breast prosthesis. The satisfaction rates with the reconstructions were similar in delayed reconstruction patients and in immediate reconstruction patients. Schain noted that women who had immediate reconstruction were less anxious, less depressed, and less hostile than those who had delayed reconstruction.

Breast reconstruction after mastectomy has been shown to increase sexual responsiveness[,]. Gerard showed that women who have breast reconstruction are more easily sexually aroused than women who have had mastectomy alone.

Wellisch studied the psychosexual impact of nipple-areola reconstruction after breast reconstruction. He found that the group that had nipple-areola reconstruction had increased satisfaction with the overall reconstruction, nude appearance, size, softness, and sexual sensitivity compared to those patients who had reconstruction without creation of the nipple-areola.

Women who feel that they will be psychologically, socially, and/or sexually improved with breast reconstruction should be offered the procedure at the earliest possible time after mastectomy.