INTRODUCTION

Breast reduction mammaplasty has become one of the most common plastic surgery procedures done in today’s society.[1,2] With the rising global obesity epidemic, an increasing number of patients are opting for surgical intervention for relief of symptoms that may
be secondary to their large and ptotic breasts. These symptoms include neck pain, back-pain, shoulder pain, poor posture, interference with ability to exercise, and problems with self-image.\[1,3-6\] Breast reduction has been found to improve patient quality of life, mitigating back, neck, and shoulder pain associated with macromastia.\[3\]

Patients report not only resolution of physical symptoms, but also improvement in mental health as well.\[4\] Moreover, breast reduction has also been found to decrease the risk of breast cancer by up to 30-50%, a difference is most pronounced when larger amounts of tissue are removed.\[2\]

Breast reduction mammoplasty techniques have a well documented history in plastic surgery literature and are constantly being challenged and modified to maximize functional and aesthetic outcomes. Since its inception in 1949, the inferior pedicle, Wise-pattern (IPWP) reduction mammoplasty technique has risen to become one of the most commonly used techniques for breast reduction due to its predictability and reliability.\[2,5\] IPWP is the mainstay of not only breast reduction in the general population, but also has been found to be effective in bariatric patients, obese patients and those with severe ptosis.\[1,6,7\]

Alternative reduction methods such as the vertical technique gained popularity due to reduced scarring and lower wound complication rates compared to the Wise pattern. Although this vertical technique improves patient satisfaction and scar formation, studies show the IPWP technique is easier for surgeons to master, has a lower overall revision rate, and allows for increased reduction of breast mass,\[8,9\] making it the preferred technique for moderate-to-large size reductions and cases of extreme ptosis\[10\] without significantly sacrificing aesthetic outcome.\[9\]

However, the IPWP mammoplasty technique is not without its flaws. It is associated with complication rates as high as 78% and problems with aesthetic appearance such as a “bottomed out” breast shape.\[2,8,9,11,12\] Complication rates in obese patients or patients receiving large volume reductions can be even higher; ranging from 35 to 78%.\[11,12\] These complications include delayed healing, infection, hematoma, seroma, nipple necrosis, fat necrosis and hypertrophic scars.\[11,13\] Most major complications occurred at the area of the inverted T junction, due to the increased tension in this area.\[14,15\]

Studies show that obese patients are predisposed to surgical complications such as delayed healing, cellulitis, hypertrophic scarring, hematoma, seroma, fat necrosis, and asymmetry requiring revision.\[4\] Although breast reduction was found to be safe in the obese patient population, some data also suggest that there is a significant increase in complication rate with increasing reduction amount and increasing BMI of patients.\[4\]

While a reliable and proven technique, the traditional inferior pedicle, wise pattern reduction mammoplasty has an increased risk of complications for large reductions in an obese population. We report a simple modification — the expanded inframammary fold (eIMF) triangle — which in our experience leads to improved outcomes by decreasing complications and improving aesthetic appearance, even in large reductions.

**MATERIALS AND METHODS**

The authors conducted an IRB approved retrospective review of 22 consecutive patients who underwent reduction mammoplasty using the modified Wise pattern expanded inframammary fold (eIMF) technique and 16 consecutive control population patients that underwent reduction mammoplasty using the typical wise pattern inferior based pedicle technique. The following data points were recorded: Patient demographics, pre-operative surgical measurements, operative specimen weight, and complications including wound dehiscence, skin necrosis, nipple-areolar complex necrosis, erythema/infection, hematoma and seroma.

The modified Wise technique was performed on a total of 43 breasts by one experienced attending surgeon at a large academic hospital. All patients received an inferior pedicle Wise-pattern reduction mammoplasty which was modified to include an 8 cm wide inferior pedicle [Figure 1]. The pedicle was then de-epithelialized and an 8 cm (base) by 3 cm (height) triangle of skin was preserved at the inferior base [Figure 2]. This expanded inframammary fold was preserved in order to reduce tension at the inverted T-closure [Figure 3] that concluded each procedure. The control population included a total of 32 breasts, and all patients received a normal Wise pattern, inferior pedicle based reduction mammoplasty from another experienced attending surgeon at the same academic hospital.

**RESULTS**

The average patient age for the control population was 31.44 years old (range 18-54), and for the modified
wise pattern inframammary fold (eIMF) was 32.25 (range 18-59). Average tissue removed per breast was 744.24 g for the control group and 1378.39 g for the eIMF group. Preoperatively in the control population, 88.89% of reporting patients were obese with an average BMI of 35.28, and 0% were smokers. For the eIMF population, 84.21% of reporting patients were obese, average BMI was 35.000, and 27.27% were known smokers. Pre-operative bra size (40.54 cm in control, 42.12 cm in eIMF), pre-operative sternal notch to nipple measurements (35.6 cm in control, 39.0 cm in eIMF), and average follow up time (4.71 weeks in control, 5.73 weeks in eIMF), were also recorded. All demographic, measurement, outcome and complication data are summarized and presented in Table 1.

Overall rate of minor dehiscence in the control group was 100% of those reporting, and 25% in the eIMF group. All minor dehiscence that occurred in the eIMF group were in smokers. Wound infection/erythema was noted in 50% of the control population cases and 4.9% of eIMF group cases. One patient receiving the modified Wise technique requested surgical revision for small dog-ears. Neither group reported any other serious complications such as seroma, hematoma, or nipple-areolar complex necrosis.

Statistical analysis was performed using an SPSS software package. A student t-test was performed for both reduction technique populations. Measures that were determined to have a statistically significant ($P < 0.05$) difference were the amount of breast tissue removed, with the eIMF technique resulting in an average increased amount of 693.96 g removed in the left breast and 571.21g removed in the right breast, supporting the efficacy of this technique. Further, two of the most cited flaws of the typical wise pattern reduction technique in obese populations were found to have a statistically significant ($P < 0.05$) reduction in incidence using the eIMF technique, with a 75% reduction in dehiscence and a 44.10% reduction in infection post-operatively in the eIMF population.

All other outcome measures were determined to be not significantly different between populations ($P > 0.05$), lending support to the similar nature of the two patient populations studied and subsequently the statistical power of this study’s comparison. Age, Height, BMI, bra size, sternal notch to both left and right nipple measurements, and follow-up time frame were all amongst these measures.

**DISCUSSION**

We recognize that a large number of plastic surgery
residents are taught to use a similar inframammary fold triangle which is often small in size (a few millimeters). In our experience, this small skin triangle was insufficient to off-load enough tension at the time of closure to prevent wound complications in today's patient population, which tends to be obese and with multiple medical co-morbidities. In our experience, expanding the height and width of this skin triangle, as described above, provides a significant advantage in these challenging breast reduction cases. This modified technique resulted in complication rates significantly lower than the historical mean (as high as 78%, [2,8,9,11,12]) a statistically significant larger mean volume reductions (1378.39 g) in a predominantly morbidly obese patient group (BMI 35.00). This method is an easily reproducible and reliable technique that produces a favourable cosmetic outcome with acceptable, sustainable results in high-risk reductions in morbidly obese patients, even for less experienced surgeons [Figures 4 and 5].

Limitations
Despite finding statistically significant decreased complications and higher volume reductions, the authors recognize that limitations to this study exist. Ideally, this study could have been performed in a randomized and prospective manner with only one surgeon performing both procedures to study this modified technique more rigorously, and the authors plan to collect more data using this technique in the future. Further, while we acknowledge the difference in resection weight between the two techniques as an advantage to the eIMF technique, it does also differentiate the control and eIMF populations further. However, the study’s focus on the patient population demographics in terms of weight and BMI lead us to believe that these findings are still

| Demographic       | Control  | Expanded Inframammary Fold (eIMF) | Combined |
|-------------------|----------|-----------------------------------|----------|
|                   | Number  | Mean (±1 stddev)                  | %        | Number  | Mean (±1 stddev)   | %       | Difference (eIMF- ctrl) | P-value | Significance |
|                   | reported|                                   |          | Reported|                                   |          |                       |         |             |
| Patients          |          |                                   |          |          |                                   |          |                       |         |             |
| Race              | 10       | 80%                               | 18       |           |                                   |          |                       |         |             |
| African American  | 8        | 20%                               | 17       | 94.4%    |                                   |          |                       |         |             |
| Caucasian         | 2        | 1                                 |           | 5.6%     |                                   |          |                       |         |             |
| Smokers           | 6        | 0                                 | 20       | 6        |                                   |          |                       |         |             |
| Age (yrs)         | 16       | 31.44±10.93                       | 20       | 32.25±11.14 | 0.81 | 975 | n/s               |         |             |
| Height (inches)   | 6        | 64.50±2.66                        | 19       | 63.95±2.57 | -0.55 | 0.653 | n/s               |         |             |
| Weight (lbs)      | 14       | 225.29±72.05                      | 19       | 203.32±39.83* | -21.97 | 0.24 | Yes               |         |             |
| BMI (kg/m²)       | 9        | 35.28±9.12                        | 19       | 35.00±6.41 | -0.28 | 0.578 | n/s               |         |             |
| Bra Size (cm)     | 13       | 40.54±3.84                        | 16       | 42.12±4.41 | 1.587 | 0.363 | n/s               |         |             |
| SN-LN (cm)        | 12       | 35.58±5.18                        | 13       | 39.77±9.41 | 4.19  | 0.057 | n/s               |         |             |
| SN-RN (cm)        | 12       | 35.62±5.60                        | 13       | 38.23±10.30 | 2.61  | 0.071 | n/s               |         |             |
| L Removed (gm)    | 15       | 734.87±322.20                      | 17       | 1428.82±788.52 | 693.96 | 0.002 | Yes               |         |             |
| R Removed (gm)    | 15       | 753.60±292.25                      | 16       | 1324.81±686.39 | 571.21 | 0.003 | Yes               |         |             |
| Follow Up (weeks) | 12       | 4.71±5.43                         | 15       | 5.73±3.60 | 1.03  | 0.45  | n/s               |         |             |
| Dehiscence        | 10       | 100%                              | 20       | 5        | 25.0% | -75% | 0.0001 | Yes               |         |             |
| Erythema/Infection| 10       | 50%                               | 17       | 1        | 4.9%  | -44.10% | 0.008 | Yes               |         |             |
| Seroma            | 10       | 0%                                | 21       | 0        | 0%    | 0%    | n/s               |         |             |
| Hematoma          | 10       | 0%                                | 21       | 0        | 0%    | 0%    | n/s               |         |             |
| NAC Necrosis      | 10       | 0%                                | 21       | 0        | 0%    | 0%    | n/s               |         |             |

SN-LN: Sternal Notch to Left Nipple distance (cm), SN-RN: Sternal notch to right nipple (cm), L Removed: Left Breast Tissue Removed (gm), R Removed: Right Breast Tissue Removed (gm), NAC Necrosis: Nipple-Areolar Complex Necrosis.
of interest and significance. Both surgeons performing breast reductions were experienced in breast reduction and practice at a large academic centre, decreasing the chance that experience in reduction led to lower complications over time during the course of these cases.

CONCLUSION

The expanded inframammary fold triangle technique for WISE-pattern reduction mammaplasty is an easily reproducible and reliable technique that produces a favourable cosmetic outcome with acceptable, sustainable results in high-risk reductions in morbidly obese patients.

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