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Correspondence and Communications

A novel approach to sensory re-innervation to the nipple areolar complex after mastectomy with implant-based reconstruction: Anatomic and technical considerations

Dear Sir,

Breast cancer is the most commonly diagnosed invasive cancer in women worldwide. The physical and psychological consequences of breast cancer can be somewhat mitigated with reconstruction, making it an integral part of the treatment approach in women requiring mastectomy.[1] With improvements in surgical management, increasing amounts of the native breast skin can be spared with oncologic safety. This skin sparing approach has improved aesthetic outcomes, but it does not affect the loss of sensation in the breast, one of the most commonly reported deficiencies after mastectomy. While some women report a degree of sensory recovery based on reinnervation from the chest wall, most still report different and diminished post-operative sensation.

The anatomical basis for innervation of the breast and NAC has been well described, with the dominant innervation originating from the medial and lateral cutaneous branches of the third to fifth intercostal nerves. As these routes of sensation are removed as part of the mastectomy, patients have decreased protective and erogenous sensation of the breast and reconstructions, and are thus, susceptible to seemingly innocuous insults. A study from our institution found that while women are mostly satisfied with the appearance of their reconstructed breast, there is still dissatisfaction with the sensory and arousal sensation of the NAC.[2]

The concept of providing innervation post-mastectomy as part of autologous reconstruction is not novel, but there has yet to be a described technique for providing sensate implant-based reconstruction. Herein, we provide our novel approach for providing sensate implant-based reconstruction by preserving and utilizing the anterior branch of the lateral fouth intercostal nerve at time of mastectomy.

Patients with a size C breast or smaller are appropriate candidates for this approach as larger breasts would require a longer nerve graft. During the nipple-sparing mastectomy, it is important to spare the nerve that supplies the nipple areolar complex (NAC). This anterior branch of the lateral fourth intercostal nerve can be identified entering into the upper outer quadrant of the breast during the mastectomy. The precise location of this nerve has been well described in anatomy texts and has been confirmed in our cadaver dissections.[3] The nerve consistently enters the lateral border of the pectoralis major at the fourth intercostal. In cases when the anterior branch of the 4th intercostal nerve is unable to be identified, the lateral perforating branch of the 4th intercostal nerve can be dissected under the serratus anterior muscle. The nerve is dissected to preserve as much length as possible to decrease the length of nerve graft that is required. However, adequate caliber cannot be compromised to allow for appropriate coaptation.

Once the nerve has been isolated and preserved, a processed nerve graft (Avance nerve graft, Axogen, Alachua, FL) is utilized as an interpositional graft connecting the donor 4th intercostal nerve to the targeted NAC. A 70 mm nerve graft is utilized and trimmed as allowed to allow for tension-free coaptation. On a histologic level, the NAC is richly innervated and has numerous small peripheral nerve fibers throughout the nipple dermis, making it primed for senate reconstruction (Figure 1). The coaptation of the native donor nerve to the nerve graft is usually performed under operating microscope or loupe magnification using 8.0 or 9.0 nylon suture. A nerve connector is commonly also utilized to avoid coaptation under tension (Axoguard, Axogen, Alachua, FL).

The tissue expander or implant is placed over or under the pectoralis major muscle as a pre-pectoral or sub-pectoral breast reconstruction, respectively. If a subpectoralis approach is used, the pectoralis muscle is released from its inframammary fold and supplemented with a dermal matrix sling to cover the lower portion of breast prosthesis. The nerve graft is passed through the pectoralis muscle using a tendon passer and is anchored to the underside of the NAC with 5-0 Prolene sutures (Figure 2).

With the majority of women who seek post-mastectomy reconstruction opting for an implant-based approach, the technical approach of utilizing a donor nerve from the abdomen to provide sensation is not possible. Our approach to provide innervation to NAC during implant-based reconstruction utilizes the lateral 4th intercostal nerve as the donor nerve along with a nerve graft and conduit. The coaptation is aided with a processed nerve allograft that is commercially available as opposed to utilizing an autograft which could result in a subsequent sensory defect.

Through cadaveric dissections and collaboration with our breast surgeons, we are now able to perform senate implant-based breast reconstruction with ease and effi-

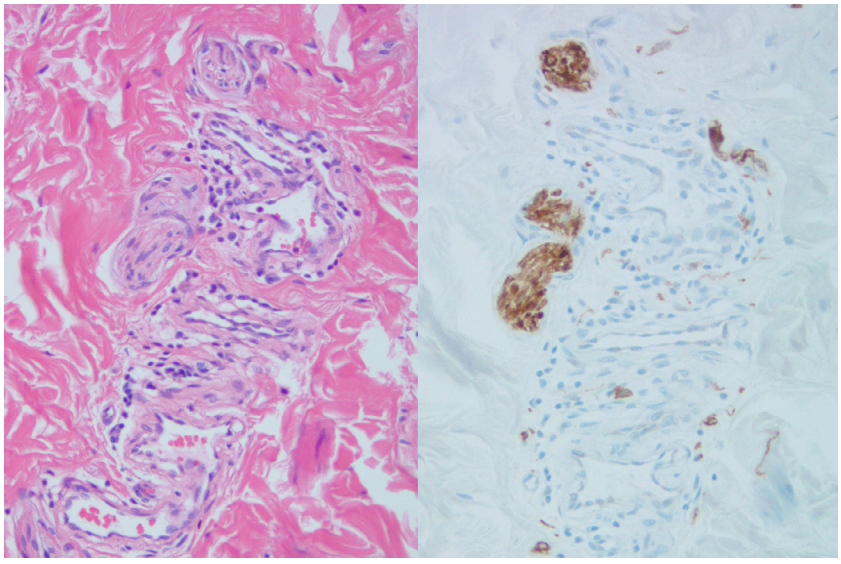

Figure 1 *High power photomicrograph of a nipple core*. Hematoxylin and eosin stained image in the left panel shows several small peripheral nerve fibers present adjacent to blood vessels within the upper dermis. Right panel is a consecutive tissue section with S100 immunostain highlighting the nerve fibers.

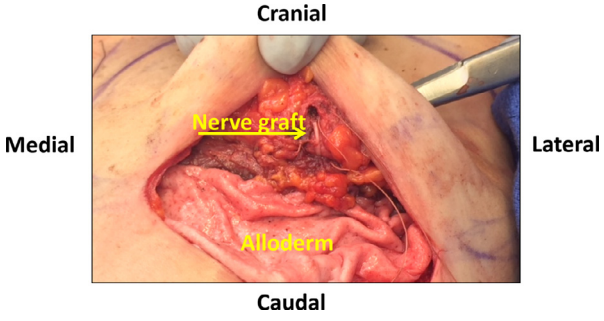

Figure 2 Intra-operative photo of the nerve graft insertion into the nipple areola complex.

ciency. We plan on monitoring the return of breast sensation in these patients as we continue to perform this procedure. Although none of our patients have developed a neuroma or consequence of undergoing this procedure, we continue to follow these patients very closely. We also plan on determining the impact that enabling potentially faster, more reproducible breast sensations has on breast-related quality of life. While a promising idea, there are many unanswered questions that remain for determining the most efficactious and reproducible way to provide breast sensation after mastectomy, and to answer these questions, more well-done prospective studies are required.

Declaration of Competing Interest

None.

Disclosures

None.

References

1. Atisha D, Alderman AK, Lowery JC, et al. Prospective analysis of long-term psychosocial outcomes in breast reconstruction: two-year postoperative results from the Michigan breast reconstruction outcomes study. *Ann Surg* 2008;**247**(6):1019–28.
2. Djohan R, Gage E, Gatherwright J, et al. Patient satisfaction following nipple-sparing mastectomy and immediate breast reconstruction: an 8-year outcome study. *Plast Reconstr Surg* 2010;**125**(3):818–29.
3. Knackstedt R, Gatherwright J, Cakmakoglu C, et al. Predictable location of breast sensory nerves for breast reinnervation. *Plast Reconstr Surg* 2019;**143**(2):393–6.

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The Butterly iQ: An ultra-simplified color Doppler ultrasound for bedside pre-operative perforator mapping in DIEP flap breast reconstruction

Dear Sir,

The deep inferior epigastric artery perforator (DIEP) flap is considered the gold standard for autologous breast reconstruction.[1] The muscle preserving technique is more challenging and time-consuming due to inconsistency of the vascular anatomy of the inferior abdominal vessels, and the position, pathway and caliber of the perforators.[2] Pre-operative planning has enabled accurate, simplified and efficient flap harvesting with assistance of Computerised or Magnetic Angiography, or Ultrasonography.[2,3] Computed Tomographic Angiography (CTA) is a commonly used standardised, reproducible investigation that allows accurate demonstration of vessel course, branching, and the location of the abdominal perforators.[2] Color Doppler Ultrasound (CDU) is a safe alternative technique that allows radiation-free dynamic pre-operative perforator mapping, but it is use is subjective and based on the experience of the operator. Recent studies have compared CTA, CDU and Magnetic Resonance Angiography (MRA).[2,3] Newer promising imaging modalities such as dynamic infrared thermography, or laser assisted indocyanine green fluorescent angiography may offer more intra-operative perfusion control planning.[3,4]

In our institution, CTA is the routine pre-operative modality for surgical planning. During induction of anesthesia, ultrasound is regularly utilised to site both the invasive arterial monitoring and the regional anesthetic block (most often a posterior transversus abdominis or quadratus lumborum block. Recently, a hand-held ultrasound device, the Butterfly iQ (www.butterflynetwork.com), has successfully been used for these procedures (Figure 1). This is a portable ultrasound-on-chip technology (2D array, 9000 micro-machined sensors) that is compatible with most current mobile and tablet devices with a USB-port. The Butterfly iQ device has been widely applied as an adjunct for intra-abdominal, vascular, cardiac and other point of care ultrasound (POCUS) examinations. It enables capture of 256-bit encrypted data with three different modes; mono- or two-dimensional and Color Doppler. The device costs 1999USD and requires a yearly 420USD license usage for the Aptible Enclave – HITRUST, SOC II Certified software. Herein; we present our experience, and to our knowledge, the first clinical use of the Butterfly iQ CDU for pre-operative bedside perforator mapping in DIEP flap breast reconstruction.

We have been using this portable device for bedside perforator mapping in all DIEP flap breast reconstructions as an adjunct to routine CTA. The CDU mapping is performed pre-operatively in the anesthetic room immediately after siting the regional blocks. Mapping could be guided in two or three dimensions by the CTA outcomes (*see supplementary figures*), as described by Wade et al., or performed blindly with the similar results, when performed by experienced operator, as proven by recent trial.[5] All sonographic reports followed a specific protocol and performed by the same operator (AP).[5] The pre-operative mapping report included; bilateral patency of the inferior epigastric pedicle from its origin marking its course superiorly to the point of penetration through the fascia. All perforators and their main arborization into the subcutaneous tissue were also marked with red marker with a 0.5 cm dot. All markings were followed by an immediate sonographic crosscheck to assure correct positioning. The diameter of perforators; preferentially at the level of the fascia penetration, was also visualised. This specifically allowed assessment of both the size of the artery and the vein, which is one of the limitations of angiography. Intra-flap branching, intra-muscular course, as well as subcutaneous interconnections between superficial and deep inferior epigastric arteries and veins were also able to be visualized (Figure 2). The level, size and pathway of the superficial arteries and veins could also be added to the mapping report in case of bilateral DIEP cases or when a second venous anastomosis is planned. This entire process added an average range of 10–20 min to the 'anesthetic time' depending on the level of detail the pre-operative mapping requires to deliver.

Figure 1 Butterfly iQ hand-held ultrasound device.

In our experience, the Butterfly iQ demonstrated an easy and quick method of identifying the main pedicle pathway in relation to the rectus abdominus muscle/fascia, visualization of intramuscular course, and selection of perforator (in relation to both arterial and venous caliber) at the level of the fascia. It further appeared to be excellent tool that visualize accurately subcutaneous perforators and intra-flap branching. This report offers an initial clinical experience of the use of the portable Butterfly iQ device in bedside perforator DIEP flap his portable device and we believe it's safe, reliable, enhances the surgeons understanding in the vascular DIEP flap vascular supply and enables a flap raising mental rehearsal especially in supervised training clinical cases.

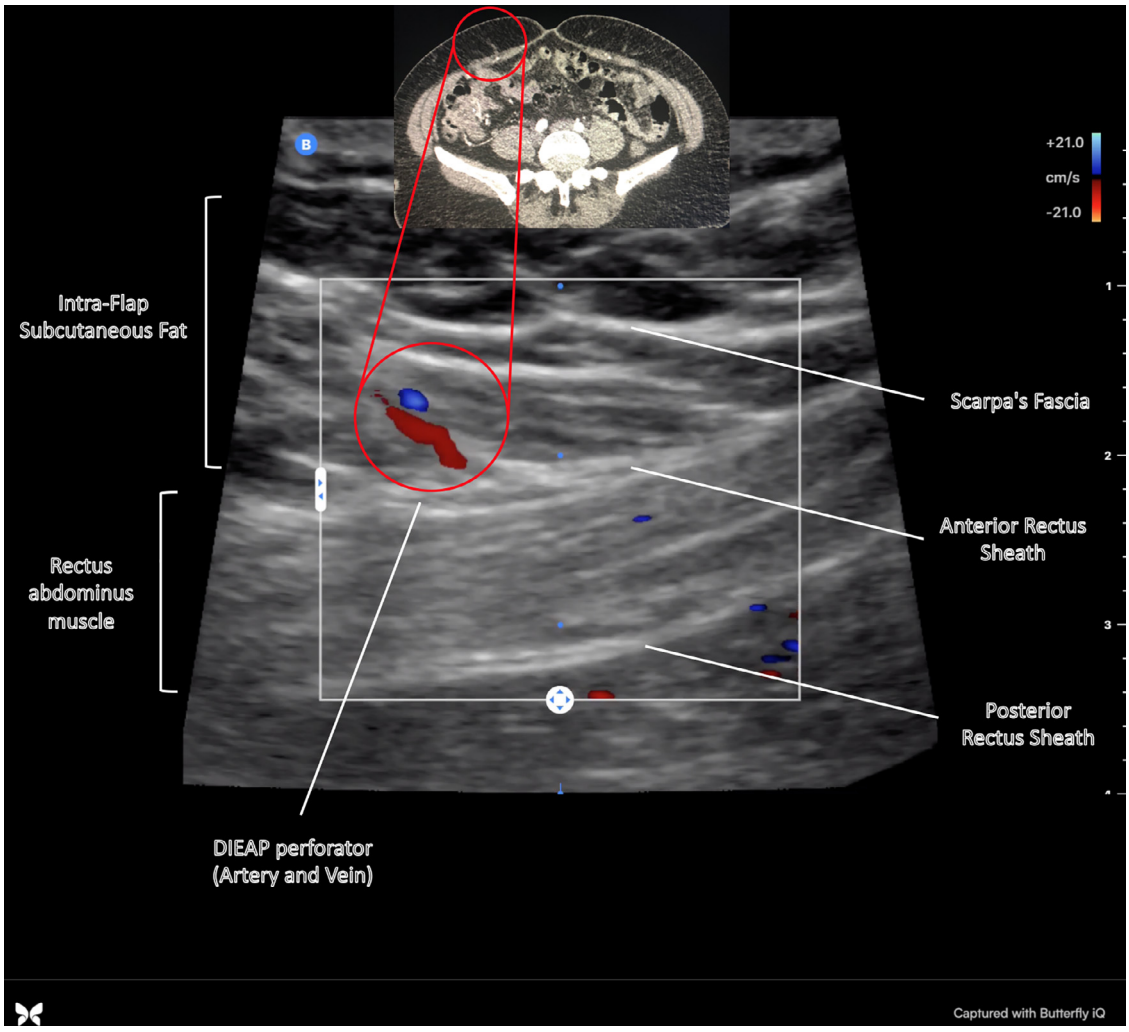

Figure 2 Butterfly iQ software screen shot, demonstrating the supra-fascial perforator and correlating with the preoperative CTA output.

Pre-operative mapping findings allow smooth intra-operative surgical steps with reliable confirmation of the Butterfly iQ predominant data regarding the perforator location, configuration and pedicle/vessels intramuscular course, however, our initial experience failed to prove reliable in mapping smaller caliber perforators with low blood volume flow.

Overall, the Butterfly iQ is a portable, cheap device that allowed radiation-free pre-operative perforators mapping in DIEP flap breast reconstruction, and we consider that in experienced hands its use could be expanded in several other reconstructive modalities. This pilot experience provides the basis for further larger objective trials that could evaluate its validity versus the standard CDU devices or even establish if routine CTA is mandatory. The Butterfly iQ CDU could potentially be a bedside or outpatient clinical examination valuable and reliable tool in the hands of the reconstructive surgeons to enhance intra-operative decision-making which could improve operating outcomes.

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Declaration of Competing Interest

None.

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Ethical approval

Not required.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.bjps.2020.01.002.

References

1. Man L-X, Selber JC, Serletti JM. Abdominal wall following free tram or DIEP flap reconstruction: a meta-analysis and critical review. *Plast Reconstr Surg* 2009;**124**:752–64.
2. Cina A, Salgarello M, Barone-Adesi L, Rinaldi P, Bonomo L. Planning breast reconstruction with deep inferior epigastric artery perforating vessels: multidetector CT angiography versus color Doppler us. *Radiology* 2010;**255**:979–87.
3. Weum S, Mercer JB, de Weerd L. Evaluation of dynamic infrared thermography as an alternative to CT angiography for perforator mapping in breast reconstruction: a clinical study. *BMC Med Imaging* 2016;**16**.
4. Chae MP, Hunter-Smith DJ, Rozen WM. Comparative analysis of fluorescent angiography, computed tomographic angiography and magnetic resonance angiography for planning autologous breast reconstruction. *Gland Surg* 2015;**4**:164–78.
5. Wade RG, Watford J, Wormald JCR, Bramhall RJ, Figus A. Perforator mapping reduces the operative time of DIEP flap breast reconstruction: a systematic review and meta-analysis of preoperative ultrasound, computed tomography and magnetic resonance angiography. *J Plast Reconstr Aesthet Surg* 2018;**71**(4):468–77.

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Diagnostic accuracy of interstitial glucose levels at the surgical wound edges to predict full thickness necrosis in mastectomy skin flaps

Dear Sir,

Mastectomy skin flap (MSF) necrosis is a challenging complication after immediate breast reconstruction for cancer treatment. It increases the risk of surgical site and implant infection, has a negative impact on the aesthetical outcome of the reconstructed breast and can lead to reconstruction failure. Viability assessment of the MSF is performed intraoperatively and remains highly subjective. Recently, the use of laser assisted angiography with intravascular injection of indocyanine green has been advocated as a new tool to predict MSF necrosis. However, the technology is expensive and not available in most settings where breast reconstruction is performed.

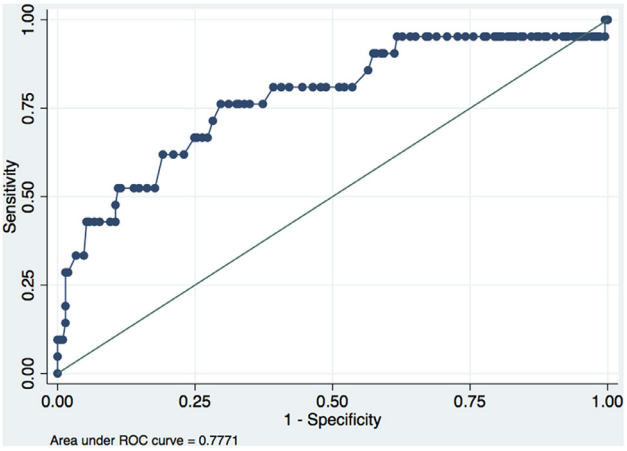

Figure 1 ROC curve for diagnostic accuracy of the absolute value of IGL.

Poorly vascularized tissue has a higher glucose consumption and lactate production due to anaerobic metabolism induced by local ischemia.[1,2] Interstitial glucose levels (IGL) measurement is a cheap and reproducible tool, and automated glycosometers are available at all health institutions. We designed a study to test the hypothesis that early metabolic changes in ischemic parts of the MSF can be measured intraoperatively to help surgeons predict full thickness necrosis (FTN).

In a prospective diagnostic test study, using a clustered outcome data design, we measured IGL in 230 different random sampling points (RSP) along the edge of the surgical wounds of 30 mastectomy patients, prior to skin closure. A picture taken at that time, with markings on the sampling sites, was compared to another picture taken 7–14 days post operatively to determine the occurrence of FTN.

Full-thickness necrosis was observed in 21 (9.1%) RSPs in 9 (30%) patients. Both the absolute and relative IGLs averages were significantly lower among the RSPs that eventually died (Absolute IGL: 126.3 ± 27.1 vs. 99.8 ± 28.3; $t(228) = 4.3$; $p<0001$) (Relative IGL: $0.86 \pm .2$ vs. $1.04 \pm .2$; $t(228) = 3.8$; $p = .0002$). The association between IGL and the odds of FTN was measured using generalized estimating equations to adjust for the hierarchical structure of the data. A 10 mg/dL decrease in absolute IGL was associated with a 71% increase in the odds of necrosis (OR=1.71; 95%CI=1.21–2.41; p=.002). A reduction of 10% in the ratio of IGL to peripheral blood glucose level was associated with a 77% increase (OR=1.77; 95%CI=1.23–2.55; p=.002). The ROC curves for the absolute and relative values of IGL are presented in Figures 1 and 2, respectively.

The C-statistic is a measure of goodness of fit for models with binary outcomes. It gives the probability that a randomly selected observation that experienced the event

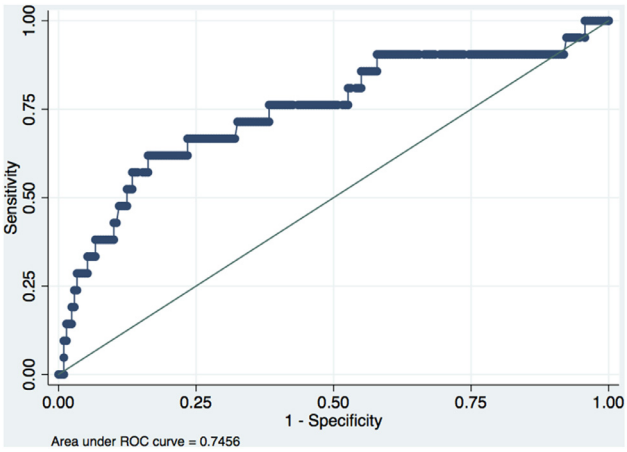

Figure 2 ROC curve for diagnostic accuracy of the relative value of IGL.

had a lower predictor score than another random observation that did not experience it. For absolute IGL, C = 0.78 (95%CI=0.65-0.92) while for relative IGL, C = 0.75 (95%CI= 0.47-0.89). These results show that both predictors have a moderate discriminative power for poorly vascularized tissues in MSF. At a cut-off of 90 mg/dL the IGL measured at the edge of the surgical wound had a specificity (Sp) of 92% (193/209) and a sensitivity (Sn) of 43% (9/21) for FTN. When a ratio of local to peripheral IGL lower than 80% was considered abnormal, the Sp and Sn of the test as a screening tool for necrosis were 89% (187/209) and 43% (9/21), respectively. When both cutoff values were considered, the Sn and Sp of the test were 67% (14/21) and 86% (179/209).

However, when making clinical decisions based on a test result, negative and positive predictive values (NPV and PPV) are most meaningful. As a measure of test performance, they depend on the prevalence of the outcome in the population being tested. In this study, IGL was used to screen for necrosis in random segments of MSFs. With a prevalence of positive outcomes of 10%, it showed a negative predictive value, or the probability of no necrosis with a negative test result, of 96%. On the other hand, the positive predictive value, or the probability of necrosis with a positive test result, was only 26%.

Although we were able to confirm our main hypothesis that tissues of the MSF under perfusional stress show early metabolic changes that can be measured intraoperatively, these results suggest that IGL underestimates the viability of the MSF and overestimate areas of FTN. To some degree, these observations are similar to what has been shown for different intraoperative angiography methods.[3,4] Recent studies have questioned the validity and economic feasibility of the unrestricted use of indocyanine green angiography as a screening tool for MSF necrosis and suggest that it should be reserved for higher risk groups.[5]

In conclusion, evaluation of the viability of MSF remains a complex process that involves subjective assessment. While no perfect test is currently available, we believe that further understanding of potential diagnostic tests to improve our ability to predict necrosis is imperative to improve patient safety.

Financial disclosure and ethical approval

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References

1. Su CT, Im MJ, Hoopes JE. Tissue glucose and lactate following vascular occlusion in island skin flaps. *Plast Reconstr Surg* 1982;**70**:202-5.
2. Cohen BE, Harmon CS, Phizackerley PJ. Glucose metabolism in experimental skin flaps. *Plast Reconstr Surg* 1983;**71**:79-86.
3. Phillips BT, Lanier ST, Conkling N, et al. Intraoperative perfusion techniques can accurately predict mastectomy skin flap necrosis in breast reconstruction: results of a prospective trial. *Plast Reconstr Surg* 2012;**129**:778e-788e.
4. Rinker B. A comparison of methods to assess mastectomy flap viability in skin-sparing mastectomy and immediate reconstruction: a prospective cohort study. *Plast Reconstr Surg* 2016;**137**:395-401.
5. Mattison GL, Lewis PG, Gupta SC, Kim HY. SPY imaging use in postmastectomy breast reconstruction patients: preventative or overly conservative? *Plast Reconstr Surg* 2016;**138**:15e-21e.

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Fat graft pre-enrichment controversy: Do we really need to pre-enrich fat grafts for improved retention?

Dear Sir,

Recent medical procedures are frequently using fat grafting for soft tissue augmentation. However, insufficient fat retention is a major impediment resulting in patient dissatisfaction due to unpredictable final outcomes of therapy. It is a major challenge not only for aesthetic, plastic and reconstructive surgeons but also a major problem for patients. Inconsistency in final clinical outcomes of fat grafting is often attributed to high rate of absorption (upto 80%)

at site of injection.[1] Nevertheless, high rate of absorption often requires multiple fat graft sessions to get satisfactory results but makes this fat grafting procedure expensive. It is therefore important to conceive strategies for enhanced fat survival and consistent clinical outcomes. Fat graft pre-enrichment with regenerative cells (ASCs, adipose tissue derived cells) has been employed to resolve the issue; however, reports are controversial and more research is required to answer basic questions to help patients and surgeons use optimized type and number of cells.[1-5]

Fat grafting is a most commonly used procedure for the augmentation of soft tissues. Reparative and regenerative properties of fat tissue are due to regenerative cells (ASCs) that exert positive effects by either differentiating into specific cells or by paracrine effects. Regenerative cells in fat can be obtained at two stages during its processing: SVF (stromal vascular fraction), a mixture of many types of cells obtained by enzymatic digestion of fat, and ASCs, a pure population of cells obtained by further culturing of SVF. Currently there exists a controversy about optimized type and number of cells for pre-enrichment of grafts for maximum survival and retention. Some recent studies have found equivalent retention of fat grafts when pre-enriched with either SVF or ASCs;[2] however, others reported no effect of pre-enrichment on fat graft retention when either SVF or ASCs were used.[4] Similarly, there is a dissonance regarding optimized cell number for graft enrichment for maximum survival. Varying number of cells had been used in published reports claiming optimized cell number for clinically relevant retention of grafted fat.[1-5] Although, pre-enrichment of fat grafts with different number of ASCs overall improved fat graft retention, these studies fail to develop consensus for an optimized cell number and cell type.[1-3]

In conclusion, it is a matter of great interest to resolve fat graft pre-enrichment uncertainty to make this procedure more consistent and reliable. In this regard, there is a dire need of optimization of best cell type and cell number for pre-enrichment and to focus on mechanisms that enhance fat retention. Direct comparison of cell fractions (SVF and ASCs), their relevant number, use of actual patients with different clinical conditions and method of pre- and post-operative assessment are important factors to optimize for better results of pre-enriched fat grafting. Such measures will definitely give relief and satisfaction to thousands of patients who are candidates of fat grafting.

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There are no financial conflicts of interest to disclose.

Declaration of Competing Interest

All authors of this study declared no conflict of interest.

References

1. Kolle SF, Fischer-Nielsen A, Mathiasen AB, et al. Enrichment of autologous fat grafts with ex-vivo expanded adipose tissue-derived stem cells for graft survival: a randomized placebo-controlled trial. *Lancet* 2013;**382**:1113–20.
2. Rasmussen BS, Sørensen CL, Kurbegovic S, et al. Cell-enriched fat grafting improves graft retention in a porcine model: a dose-response study of adipose-derived stem cells versus stromal vascular fraction. *Plast Reconstr Surg* 2019;**144**(3):397e–408e.
3. Bashir MM, Sohail M, Fridoon JA, et al. Pre-enrichment with adipose tissue stem cells improves fat graft retention in patients with contour deformities of face. *Stem Cells Int* 2019:5146594. doi:10.1155/2019/5146594.
4. Peltoniemi HH, Salmi A, Miettinen S, et al. Stem cell enrichment does not warrant a higher graft survival in lipofilling of the breast: a prospective comparative study. *J Plast Reconstr Aesthet Surg* 2013;**66**(11):1494–503.
5. Kakudo N, Tanaka Y, Morimoto N, et al. Adipose-derived regenerative cell (ADRC)-enriched fat grafting: optimal cell concentration and effects on grafted fat characteristics. *J Transl Med* 2013;**11**:254. doi:10.1186/1479-5876-11-254.

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Immediate versus delayed autologous breast reconstruction

Dear Sir,

We read with great interest the retrospective matched cohort study by Dewael et al.[1] on immediate versus delayed autologous breast reconstruction in the context of post mastectomy radiotherapy (PMRT). We would like to raise some important issues compromising the interpretation of the data and conclusion.

The authors have divided complications into early and delayed. However, the complications themselves have not been stratified according to clinical management using accepted and validated tools, such as the Clavien-Dindo classification (CDC). This may culminate in heterogeneous outcome reporting, precluding accurate overall summary measures. Moreover, the study is retrospective with inherent challenges associated with retrospective case reviews and inaccurate data collection, which may further reduce the reliability of the overall summary measures. The authors report "*no disputes in stating or defining fat necrosis or contracture*". However, the diagnosis was determined by the physicians, where there may be significant inter-rater

and intra-rater variation in assessment, further reducing the reliability of the findings. Additionally, capsular contracture was not stratified as per the Baker's classification.

Secondly, a major limitation of this study is the lack of evaluation of patient-reported outcomes (PROs), which are a fundamental part of the reconstructive breast surgery core outcome set.[2] Measurement and reporting of PROs using robust, disease-specific tools such as the BREAST-Q[3] should be mandatory. The authors purport that for patients needing PMRT, reconstruction should be delayed, based on greater fat necrosis and skin contracture rates, with no evaluation of PROs. However, clinical complications may not always correlate with PROs. Moreover, Billig et al.[4] demonstrated that patients, from the Mastectomy Reconstruction Outcomes Consortium (MROC) cohort, with delayed reconstruction reported significantly lower pre-reconstruction scores for breast satisfaction and sexual and psychological well-being compared with patients with immediate reconstruction. Thus, it may be inferred that the benefit of the proposed lower rates of fat necrosis and skin contracture as reported by Dewael et al.[1] for delayed reconstruction maybe offset by the lower health-related quality of life (QOL) scores.

Thirdly, whilst the authors have expressed concerns on the oncological safety of immediate reconstruction, there is now a large body of literature refuting an increase in local recurrence with immediate compared with delayed reconstruction.[5] Finally, the authors' recommendation for delayed reconstruction in the setting of PMRT does not take into account evaluation of cost. Robust cost analysis should be undertaken using Incremental Cost Effectiveness Ratios (ICER) and calculating a PRO-Quality Adjusted Life Year (QALY), i.e. the additional cost of an intervention to achieve one year of perfect health-related QOL.

Based on the aforementioned points and the relative scarcity of high quality evidence, we disagree with the strong recommendation of the authors for delayed reconstruction in the setting of PMRT. Higher quality, prospective Level I/II data is paramount with robust reporting of core outcome set with clinical complications defined *a priori*. Combined with utilization of disease-specific PRO tools and cost-analysis will help determine the optimal sequence of reconstruction and radiotherapy, facilitating informed consent, shared decision-making and national/international guidelines.

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Declaration of Competing Interest

None.

Acknowledgments

None.

References

1. Dewael S, Vandevoort M, Fabre G, Nanhekhan L. Immediate versus delayed autologous breast reconstruction: a retrospective matched cohort study of irradiated patients. *J Plast Reconstr Aesthet Surg* 2019;**72**:1769–75.
2. Potter S, Holcombe C, Ward JA, Blazeby JM. Development of a core outcome set for research and audit studies in reconstructive breast surgery. *Br J Surg* 2015;**102**:1360–71.
3. Pusic AL, Klassen AF, Scott AM, Klok JA, Cordeiro PG, Cano SJ. Development of a new patient-reported outcome measure for breast surgery: the breast-q. *Plast Reconstr Surg* 2009;**124**:345–53.
4. Billig J, Jagsi R, Qi J, et al. Should immediate autologous breast reconstruction be considered in women who require postmastectomy radiation therapy? a prospective analysis of outcomes. *Plast Reconstr Surg* 2017;**139**:1279–88.
5. Gieni M, Avram R, Dickson L, et al. Local breast cancer recurrence after mastectomy and immediate breast reconstruction for invasive cancer: a meta-analysis. *Breast* 2012;**21**:230–6.

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Neuroma formation following fascicular turnover flap nerve repair

Dear Sir,

Fascicular turnover flap was first reported by Koshima et al. in 2010 as an alternative to autologous nerve grafts in nerve gap repair.[1] In this method, nerve fascicles are split from the proximal and/or distal stump of the nerve gap and turned over the nerve gap to reach the contralateral nerve end. Unlike nerve gap repair with a free nerve graft, retention of the donor nerve is possible, and because a part of the fascicular turnover flap is connected to the nerve stump, axonal sprouting toward distal direction through the communicating branches between the fascicles is possible and vascularisation of the fascicular turnover flap is maintained by the rich microvascular networks around the fascicles.

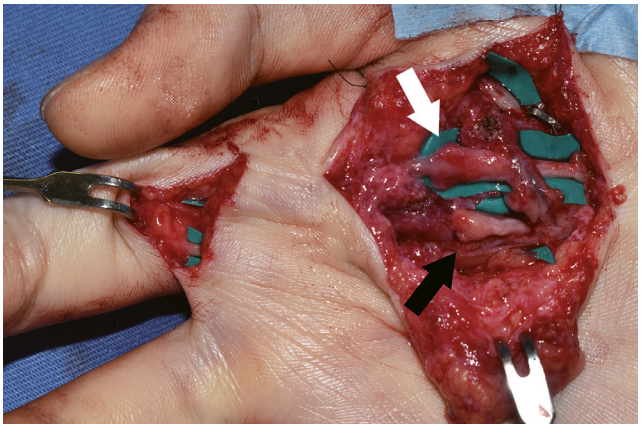

Figure 1 Intraoperative view. A neuroma was found at the originally proximal stump of the radial digital nerve gap, which had been repaired using fascicular turnover flap (white arrow). There also was a neuroma at the proximal stump of ulnar digital nerve which could not be repaired in the acute phase surgery (black arrow). Both neuromas were asymptomatic.

Therefore, better nerve regeneration is expected compared with free nerve graft or artificial nerve conduit

Although this method is a viable option for nerve repair and its utility has been described both experimentally and clinically,[1-4] there may be a risk of postoperative neuroma formation. A 19-year-old man presented to our department with an open fracture of the right second metacarpal bone and subsequent rupture of both digital nerves. In fact, the nerves were significantly injured and only the radial digital nerve could be repaired. The 25-mm -long nerve gap was repaired using bilateral turnover flaps from both the proximal and distal nerve stumps, to facilitate tension-free suture. However, the postoperative sensory recovery was not good; the Semmes Weinstein monofilament (SW) value was 4.56 on the distal pulp of the index finger at the 10-month follow-up. Therefore, we performed a re-operation: indeed, we found a neuroma at the repaired radial digital nerve which was not symptomatic preoperatively (Figure 1). The neuroma was excised, and the nerve was dissected until intact nerve stumps were identified, which resulted in a 55-mm -long nerve gap. The nerve was reconstructed using a vascularised femoral nerve graft. Postoperatively, the sensory recovery improved, and the SW value dropped to 3.84 by the 15th month of follow-up after the operation.

After traumatic nerve injury, nerve regeneration is normally initiated by axonal sprouting from the proximal nerve end. However, in case of inappropriate coaptation of the proximal and distal nerve fascicles, the sprouting proximal nerve may form a neuroma, either symptomatic or asymptomatic.[5] In the fascicular turnover flap nerve repair, part of the nerve fascicles, particularly the proximal nerve stump, become blind-ending and complete coaptation of all nerve fascicles is thereby difficult, which can cause neuroma formation. Moreover, as part of the nerve fascicles is split from the intact nerve trunks, the fascicular turnover flaps affect the intact nerve. When re-operation is indicated, complete excision of neuroma and dissection until intact nerve stumps may result in a larger nerve defect than the original nerve gap. In such cases, with the large nerve defect and severely scarred wound bed due to the prior trauma, free vascularised nerve graft reconstruction may be preferable.[1]

Although further studies are required to investigate incidence and symptoms, neuroma formation is a possible postoperative complication of fascicular turnover flap nerve repair, and when re-operation is indicated, it may result in a larger defect than the original nerve gap, requiring free vascularised nerve grafts.

Declaration of Competing Interest

None.

Acknowledgements

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References

1. Koshima I, Narushima M, Mihara M, Uchida G, Nakagawa M. Fascicular turnover flap for nerve gaps. *J Plast Reconstruct Aesthet Surg* 2010;**63**:1008–14.
2. Ito T, Nakagawa R, Ishiura R, Yamamoto T, Narushima M. Nerve reconstruction after sural nerve biopsy with supermicrosurgical fascicular turnover flap. *J Plast Reconstruct Aesthet Surg* 2016;**69**:146.
3. Choi J, Kim DS, Kim J, Jeong W, Lee HW, Park SW. Better nerve regeneration with distally based fascicular turnover flap than with conventional autologous nerve graft in a rat sciatic nerve defect model. *J Plast Reconstruct Aesthet Surg* 2019;**72** (Ahead of print).
4. Uehara M, Wei Min W, Satoh M, Shimizu F. Fascicular turnover flap in the reconstruction of facial nerve defects: an experimental study in rats. *J Plast Surg Hand Surg* 2019;**53**:155–60.
5. van der Avoort DJ, Hovius SE, Selles RW, van Neck JW, Coert JH. The incidence of symptomatic neuroma in amputation and neurorrhaphy patients. *J Plast Reconstruct Aesthet Surg* 2013;**66**:1330–4.

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Will the real jumping man flap please jump up?

Dear Sir,

Plastic surgery is a field that deals with the exacts and the particulars, perhaps more so than other specialties. Nomenclature within plastic surgery should form part of that precision and so when it remains substandard then it should be challenged. Over time, the jumping man flap is one such name that has been mainly attached to two surgical flaps that share resemblance to a jumping man and each of these jumping man flaps may be used for different surgical indications.[1] However, the attachment of the "jumping man flap" label to these two different flaps, as has been done before,[1] presumes (incorrectly) that these two flaps can be used interchangeably. This imprecision may subsequently lead to confusion when performing and executing these flaps. A closer evaluation of the different versions of the jumping man flap is therefore warranted to determine their indications and which flap truly deserves the title of the "jumping man flap".

The first contender for the title of the "jumping man flap" is the double opposing Z-plasty with a Y to V advancement (Figure 1). The flap was originally described by Hirshowitz and colleagues for web contractures of the first web space of the hand.[2] This flap can be used for web contractures of other web spaces, and may be related to congenital, post-traumatic or nerve-related injuries.[2] Details on how to undertake the flap have been published elsewhere,[2,3] but in brief: the length of the flap (A to B) is designed over the full length of the webspace and

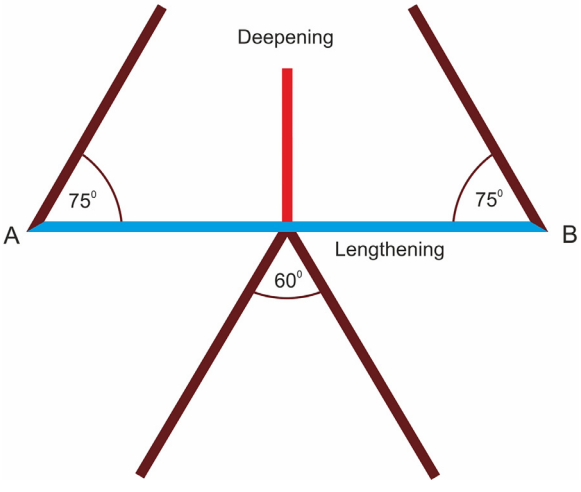

Figure 1 Double opposing Z plasty with a Y to V advancement. Flap design. A to B (line in blue) provides the lengthening of the flap. The line in red provides the advancement of the flap. The lengths of each of the lines and angles of the "Z" remain the same.

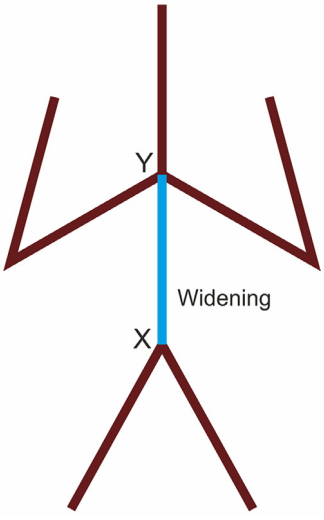

Figure 2 Mustardé flap for eye correction. (A) Flap design. In addition to the lengthening and widening seen in the double opposing Z plasty with a V to Y advancement, this flap has an additional vector (blue line) which provides a widening effect.

is marked first. The sitting of the central advancement of the flap (i.e. the "head of the jumping man") is designed next and based on the quality of the palmar and dorsal skin and should be placed on the side with the greatest laxity (Figure 1). It is the central advancement of the flap that provides the deepening of the webspace and its length is designed based on how much the webspace needs to be deepened. As this flap incorporates double opposing Z plasty, the lengths of the incisions that form the Z plasty component of the flap remain equal and thus equate to half the length of the webspace (i.e. half of A to B). When insetting the flap, some trimming may be required to shape it into position. The double opposing Z plasty component of the flap provides the lengthening of the webspace and the flap. The end result is a lengthened and deepened webspace (Supplementary Figure 1).

The second contender for the jumping man title is Mustardé's flap, originally described for correction of the medial canthus (Figure 2).[3,4] Design of this flap requires meticulous measurements of lines and angles, which has been described by others as being cumbersome to perform.[5] The key modification of this flap compared to the double opposing Z plasty with a Y to V advancement is that this flap incorporates an additional vector (Points X to Y) that gives this "jumping man flap" it's "body." Therefore, in addition to a deepening and lengthening effect, the additional vector of this flap provides a widening effect, which may be merited in correcting the epicanthal fold (Supplementary Figure 2). Although variations of these flaps have been generated, and the alternative flap have been reported to work effectively for correction of the medial canthus and of web contractures,[3-5] the differences of these flaps have purpose and create different effects.

Consequently, it is our opinion that only one of these flaps should be given the title of the "jumping man flap"; and that flap should be Mustardé's flap for eye correction as this flap has a closer resemblance to a jumping man, given

the "body" that it has, which is absent from the double opposing Z plasty with Y to V advancement flap. However, as the double opposing Z plasty with Y to V advancement flap is such a powerful workhorse, we believe that it is very much deserving of an eponymous name; one that is less garrulous than its full description. We therefore suggest that it should be referred to as the "short jumping man flap" as this would be an accurate description of its resemblance, while also distinguishing it from Mustardé's flap for eye correction.

Ethical considerations

None.

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Declaration of Competing Interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.bjps.2019.12.004.

References

1. Diver AJ, Lewis HG. Modification of jumping man flap. *J Plast Reconstr Aesthet Surg* 2019;**72**(11):1856–71. [cited 2019 Oct 2]; Available from https://linkinghub.elsevier.com/retrieve/pii/S1748681519302591. doi:10.1016/j.bjps.2019.05.051.
2. Hirshowitz B, Karev A, Rousso M. Combined double Z-plasty and Y-V advancement for thumb web contracture. *Hand* 1975;**7**(3):291–3. [cited 2019 Oct 2]Available from: http://www.ncbi.nlm.nih.gov/pubmed/1107185.
3. Chapman P, Banerjee A, Campbell RC. Extended use of the Mustardé dancing man procedure. *Br J Plast Surg* 1987;**40**(4):432–5. [cited 2019 Oct 2]Available from https://linkinghub.elsevier.com/retrieve/pii/0007122687900506.
4. Mustarde JC. Epicanthus and telecanthus. *Br J Plast Surg* 1963;**16**:346–56. [Internet].[cited 2019 Oct 4]Available from: http://www.ncbi.nlm.nih.gov/pubmed/14077771.
5. Anderson RL, Nowinski TS. The five-flap technique for blepharophimosis. *Arch Ophthalmol* 1989;**107**(3):448–52. (Chicago, Ill 1960) [Internet][cited 2019 Oct 4]Available from http://archopht.jamanetwork.com/article.aspx?doi=10.1001/archopht.1989.01070010458045.

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Lymphovenous anastomosis using the venous coupler

Dear Sir,

Lymphedema surgery has made tremendous advances and is quickly becoming the standard of care for patients suffering from lymphedema.[1,2] A lymphovenous anastomosis (LVA) creates a shunt allowing lymphatic fluid to drain into the systemic circulation. Numerous studies have demonstrated successful outcomes using this approach, and in experienced, skilled hands, is reproducible, predictable, and effective in improving patients' lymphedema but remains technically challenging and is dependent on specialized equipment. However, in certain circumstances, it is possible to employ standard microsurgical techniques in lymphedema supermicrosurgery. Here, the authors present the largest experience using the venous coupler (Synovis Inc., Birmingham, AL) for LVA.

The authors prefer to use indocyanine green (ICG) both for staging and for localization of the lymphatic channels. Patients with early stage lymphedema based on the MD Anderson classification system (stages 1 and 2) typically undergo LVA while patients with more advanced lymphedema (stages 3 and 4) have historically undergone a vascularized lymph node transfer.[2] Patients with stage 1 lymphedema have an abundance of lymphatic channels with normal architecture and minimal dermal backflow. Stage 2 has increased dermal backflow but still patent channels amenable for LVA. Patients with stage 3 have a predominance of dermal backflow with limited channels typically located distally in the extremity, and stage 4 is defined as diffuse dermal backflow with no distinct channels seen on ICG. Following injection of ICG, the skin incision is planned where a shadow representing a recipient venule crosses the lymphatic channels. Local anesthetic containing epinephrine is injected predominantly for hemostatic purposes followed by lymphozurin distally. Careful dissection is then performed to isolate the maximal length on both vessels. The venule is loaded first followed by the lymphatic (Supplemental Figure 1 and 2). It is necessary to close the coupler partially in order to reduce the distance between the two sides of the coupler when loading the vessels (Figure 1).

Seven patients, three males and four females (average age: 63.5 years, range: 47–77 years) underwent a coupled LVA. Five patients developed lymphedema following treatment for breast cancer, one following melanoma, and

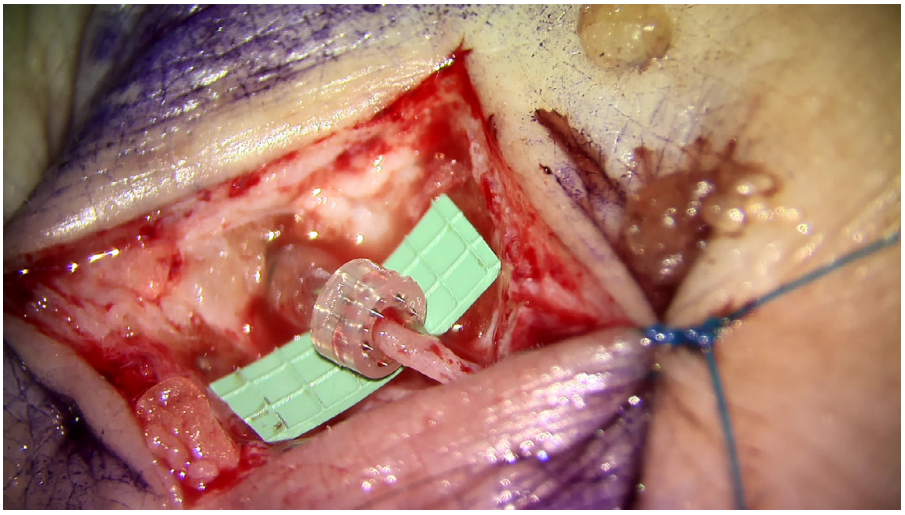

Figure 1 Completed coupled lymphovenous anastomosis.

one following treatment for squamous cell carcinoma. Six patients underwent axillary node dissections, five patients received chemotherapy, and five had radiation therapy. All LVA were performed in the upper extremity using a 1.0 mm coupler except for one where a 1.5 mm coupler was used. Three patients were classified as stage 2, and four patients were classified as stage 3 based on the MD Anderson classification system. With a mean follow-up time of 16.1 months (range: 8.9–26.0 months), all patients demonstrated subjective improvements in arm swelling, heaviness, and range of motion (Supplementary Figure 3). No patients suffered infections or cellulitis following surgery, and all but one have discontinued routine use of compression garments. One patient had no change in volumetric measurements, but the mean volume reduction in the remaining patients was 26.2%, 25.1%, and 21.0% at 3, 6, and 12 months respectively.

The field of super microsurgery is based on suturing vessels less than a millimeter in size; however, in certain circumstances, lymphatic vessels can be identified that are larger in size which are amenable to standard microsurgery similar to digital replants or pediatric microsurgery. While suturing a one-millimeter LVA is technically easier than using a venous coupler, studies have demonstrated poor long-term patency of LVA.[3] Perhaps the long-term patency of coupled LVA may be superior to the current high long-term failure rates of hand-sewn anastomoses. Recent data also suggest significantly lower rates of venous thrombosis using the coupler compared to hand-sewn anastomoses in standard free tissue transfer.[4] The benefits of a stented anastomosis, less intraluminal foreign body, and optimal intimal approximation may be extrapolated to LVA and may be even more critical due to smaller caliber vessels and lower flow anastomoses.

While our experience is limited due to the rarity of finding lymphatic vessels of sufficient size, there are some technical points to consider when performing a coupled LVA. In order to safely dock each vessel, there needs to sufficient length so there is no tension on the vessels. It is also necessary to close the coupler partially to bring the two sides into closer proximity when loading each vessel. The recipient vein should be loaded first followed by the lymphatic as the vein has a thicker wall and is less likely to tear while the coupler is manipulated and positioned for loading the lymphatic vessel. Patency of the anastomosis should always be confirmed with either drainage of lymphozurin, lymphatic fluid, or ICG (Figure 2).

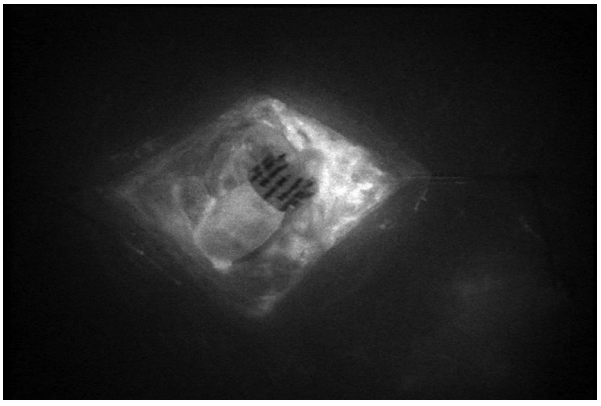

Figure 2 Intraoperative photo demonstrating a coupled lymphovenous anastomosis with flow of indocyanine green through the anastomosis from the lymphatic into the vein.

There are significant limitations to this technique, the greatest being the rare circumstance when a large lymphatic is identified which explains the limited number of patients in the present study. However, to our knowledge, there is single case report describing a coupled LVA which failed to provide any outcomes or follow-up data.[5] Patient reported outcomes (PROs) using a validated PROs metric would have strengthened the findings; however, all patients included had subjective improvement in their symptoms compared to 96% of patients using a hand-sewn technique from our institution.[2] Larger numbers are needed to determine whether a coupled LVA is superior to a hand-sewn LVA, particularly whether the coupler can maintain long-term patency of the anastomosis.

Disclosure

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.bjps.2020.01.012.

References

1. Koshima I, Inagawa K, Urushibara K, Moriguchi T. Supermicrosurgical lymphaticovenular anastomosis for the treatment of lymphedema in the upper extremities. *J Reconstr Microsurg* 2000;**16**(6):437–42.
2. Chang DW, Suami H, Skoracki R. A prospective analysis of 100 consecutive lymphovenous bypass cases for treatment of extremity lymphedema. *Plast Reconstr Surg* 2013;**132**(5):1305–14.
3. Tourani SS, Taylor GI, Ashton MW. Long-Term patency of lymphovenous anastomoses: a systematic review. *Plast Reconstr Surg* 2016;**138**(2):492–8.
4. Kulkarni AR, Mehrara BJ, Pusic AL, et al. Venous thrombosis in Handsewn versus coupled venous anastomoses in 857 consecutive breast free flaps. *J Reconstr Microsurg* 2016;**32**(3):178–82.
5. Sharma P, Sharma H, CyrM St, Griffiths M. Never fear the venous-lymphatic coupler is here!. *J Plast Reconstr Aesthet Surg* 2015;**68**(2):290–1.

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The Lymphatic Flow-Through (LyFT) flap: Proof of concept of an original approach

Dear Sir,

The inguinal area is often involved in oncologic debulking surgeries, lymphadenectomies and vascular procedures that can jeopardise blood flow and compromise wound healing. Radiotherapy and venous insufficiency can further aggravate the clinical picture. among principal etiologies of wound healing failure at the inguinal region we can consider wide soft tissues defects with dead space, bacterial contamination, lymphatic leaks, iterative procedures and general comorbidities such as diabetes, cachexia and tabagism. The post-operative morbidity associated with inguinal surgery can have an incidence of complications as high as 40%.[1]

When soft tissue defects are associated with the disruption/resection of inguinal nodes and lymphatic pathways, groin defects become particularly challenging with extremely high complication rates. In such cases, key plastic surgical principles such as dead space obliteration and coverage with well-vascularized tissue may not be enough in reason of the lymphatic insufficiency that entertains a chronic lymphorrea, eventually associated to lower limb or genital lymphedema, causing extremely high morbidity and prolonged hospital stays.

For this reason, reconstruction should not only address the lack of tissue bulk, but also attempt to restore the lymphatic drainage for proper anatomical restoration and ideally avoid long term complications such as chronic lymphedema.

The pedicled anterolateral flap (ALT) represents one of the most appropriate local solutions for groin defects in reason of its anatomical position (far from potentially irradiated fields but with long pedicle and arc of rotation), versatility, possibility for chimeric muscle harvesting and the relatively low donor site morbidity.[2]

The concept of shunting lymph into the venous system, by-passing an obstruction or an area where the lymphatic network is no longer competent is nowadays a well-established microsurgical or supermicrosurgical practice. Multiple Lymphatic-Venous Anastomoses (MLVA), routinely used for lower limb lymphoedema, represents a single-site microsurgical technique where multiple lymphatics converge into a single vein with a competent valve.[3] This approach has been used successfully at the groin to treat lymphoceles and has shown to be effective for the prevention and treatment of lower limb lymphedema, thereby improving the patient's quality of life and decreasing health care costs.[4]

However, when the venous system has been severely jeopardized at the inguinal region (in reason of large oncologic resections, aggressive lymphadenectomies, adjuvant radiotherapy, multiple vascular procedures), MLVA may be technically impossible due to lack drainage veins and distal LVAs may be ineffective in treating proximal lymphorreas or an established limb lymphedema.

Flow-through flap have been described in literature as useful way to encompass an artery or venous[5] defect. We developed the concept of using a flap pedicle run-off as recipient vein for multi lymphatic into vein (MLVA) anastomoses. This procedure allows to cover inguinal defects while at the same time it brings a quality vein that can receive lymphatic flow more distally on the thigh, before it reaches the resected or jeopardised area (Figure 1).

ALT flap is particularly versatile as its perforators arise from the descending branch (DB) of the lateral circumflex femoral artery (LCFA) pedicle, which then continues to the

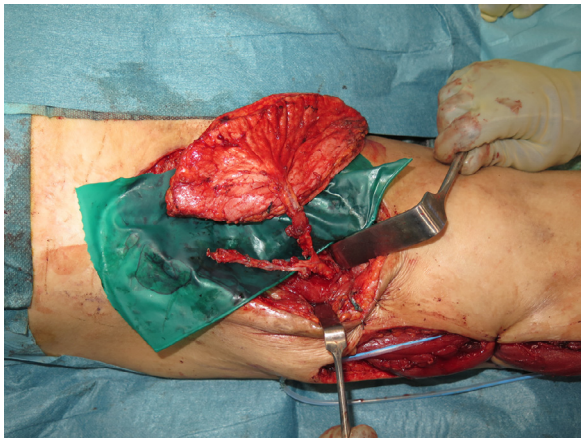

Figure 1 ALT flap with Descending branch of LCFA, that can be orientated according to the location of the afferent lymphatics.

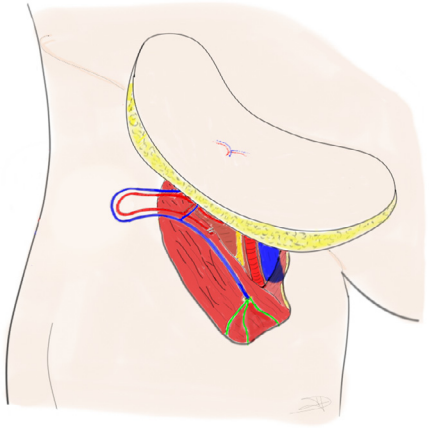

Figure 2 LyFT flap concept - Groin defect with ALT flap, pedicle run-in and MLVA.

lateral distal thigh. After isolating the paddle on the perforator(s), we dissected out the DB of the LCFA as an ideal source of effective draining veins. The length and number of collateral veins required can be adapted according to the location of the lymphatic leaks or to the number of available severed lymphatics.

MLVAs can be performed on the DB, potentially using both venae comitans which are normally long enough to be placed when needed for the anastomoses.

In case of lymphorrea or lymphedema, interrupted lymphatic vessels where revealed thanks to per-operative Indocyanine green fluorescent and blue patent dyes. After flap inset and dissection of the DB, lymphatics were shunted according to the with LyFT technique (Figure 2). No postoperative flap oedema or seroma requiring local drainage was induced. A rapid healing was obtained in all five cases with sudden cease of the lymphorrea. In case of preoperative lymphoedema, pre-operative lymphoscintigraphy and lymphofluoroscopy offered a complete plan for by-pass. Follow up at 6 months showed an objective decrease of the excess limb volume and the frequency of physical therapies, with an improvement of heavy feeling sensation objectivated by perometer measurements.

The LyFT can be an effective new solution in those cases requiring restoring of the lymphatic drainage while needing soft tissue reconstruction. Despite the low number of cases and the limited indication, this approach proofed to be an effective tool reducing frightened common complications after groin debulking procedures, such as seromas, lymphorrea, wound dehiscence and secondary lymphedema formation. Moreover, the LyFT flap approach could be potentially extended to other pedicled or free flaps with "run in" receiving veins for MVLA.

Declaration of Competing Interest

None.

Funding

None.

References

1. Exton RJ, Galland RB. Major groin complications following the use of synthetic grafts. *Eur J Vasc Endovasc Surg* 2007;**34**(2):188–90.
2. Scaglioni MF, Fakin RM, Barth AA, et al. Bilateral pedicle anterolateral thigh (ALT) flap combined with bilateral sartorius muscle flap for reconstruction of extensive perineoscrotal and medial thigh defect because of Fournier's gangrene. *Microsurgery* 2017;**37**(6):669–73.
3. Campisi CC, Ryan M, Boccardo F, et al. A single-site technique of multiple lymphatic-venous anastomoses for the treatment of peripheral lymphedema: long-term clinical outcome. *J Reconstr Microsurg* 2016;**32**(1):42–9.
4. Boccardo F, Valenzano M, Costantini S. LYMPHA technique to prevent secondary lower limb lymphedema. *Ann Surg Oncol* 2016;**23**(11):3558–63.
5. Fujiki M, Miyamoto S, Sakuraba M. Flow-through anastomosis for both the artery and vein in leg free flap transfer. *Microsurgery* 2015;**35**(7):536–40.

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Burn injuries from laser tattoo removal

Dear Sir,

Approximately one in five British adults have at least one tattoo.[1] Previous studies have suggested that a third of people regret having a tattoo but less than half of them would consider having their tattoo removed.[2] Non-surgical laser tattoo removal is currently not regulated in England and is not widely available on the NHS. Laser tattoo removal is often a prolonged, multi-staged, and painful procedure with well-documented associated risks.[3] Most people seek laser removal treatment in the private sector from practitioners who may have little experience. In spite of this there is only one reported case of burn injury associated with laser tattoo removal in English literature which is incongruent with our experience.[4]

Methods

We searched our local prospectively maintained International Burn Injury Database (iBID) for any burn injuries related to laser tattoo removal from 2000 to 2018. We collected data including demographics, circumstances of the injury, characteristics of the burn wound, and outcome measures including time to healing and need for surgery.

Results

We identified 6 cases that were referred to our Regional Burns Service, all of which had occurred between 2013 and 2018 with five of these cases occurred in the last two years analysed (2017–2018). There were no cases recorded in the preceding 12 years (2000–2012). Three patients were male and three female with an average age of 34 (range 26–48). The injuries occurred across a range of private sector settings including specialist clinics, beauty and tattoo parlours. None of the patients received first aid. All were referred after being seen in Emergency Departments with a mean time from injury to referral of 10.5 days (2–42). Details of the laser equipment used were not available. Two patients had received two sessions of laser therapy in short succession, for the remainder any preceding treatments weren't recorded. All burn injuries were sustained to the upper limbs. Four patients had superficial dermal burns, one had deep dermal burns and one had full thickness burns. The average TBSA was 0.73% (range 0.1–1%). Five patients were managed as outpatients and one required admission for two days due to infection. No patients died from their burn and all healed without surgical management with an average time to healing of 15 days (6–51).

Discussion

In England non-medical providers using lasers for purely cosmetic purposes are not required to register with any formal body or hold any specific qualifications (although local councils can require this as they see fit). In 2016 the Joint Council for Cosmetic Practitioners was set up and requires registered practitioners undertaking laser tattoo removal to achieve at least a Level 5 qualification or equivalent verified experience.[5] However this registration remains voluntary. There is no data available on the types of qualifications held by other unregistered practitioners.

Our data highlights a recent new trend in referrals to burns services for management of burns associated with laser tattoo removal. There was often a considerable delay in time to presentation following these injuries. While all burns healed without surgical management the injuries still resulted in a need for costly specialist management, associated acute pain and long term scarring and distress for the patients. It is likely that this work underestimates such injuries as many more may have been managed by emergency departments, burns units or facilities or primary care providers.

Conclusions

Although the numbers involved are small we have identified a new trend in recent years in burns associated with laser tattoo removal requiring specialist burns management. These cases resulted in an inevitable cost to the health service. We propose that the cost of any NHS treatment arising from complications of private laser removal treatment should be reclaimed from the private providers or their insurers. Although positive moves have been made in recent years to improve regulation of this industry, at present registration remains voluntary and relies on patients seeking out appropriately qualified providers.

Declaration of Competing Interest

None of the authors have any conflicts of interest to declare.

References

1. YouGov. UK Tattoos [Internet]. 2015. Available from: https://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/egt6ly4bkt/InternalResults_150710_tattoos-Website.pdf.
2. Aslam A, Owen C. Fashions change but tattoos are forever. In: Proceedings of the British association of dermatologists' annual conference, Birmingham; 2012. [Internet] Available from: https://www.skinhealthinfo.org.uk/fashions-change-but-tattoos-are-forever/.
3. Naga LI, Alster TS. Laser tattoo removal: an update. *Am J Clin Dermatol* 2017;**18**(1):59–65.
4. Hammes S, Raulin C. Deep burns from Nd:YAG laser treatment for tattoo removal. *Dtsch Arztebl Int* 2018;**155**(37):610.
5. Joint Council for Cosmetic Practitioners. Competency framework for cosmetic practice. 2018;(September):1–47. Available

from: https://www.jccp.org.uk/ckfinder/userfiles/files/JCCP%20Competency%20Framework%20final%20V8%20September%202018.pdf.

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UV nail lamps, is there a malignancy risk? A review of the literature

Dear Sir,

Manicures are an increasingly popular treatment. Ultraviolet(UV) nail lamps which primarily emit UVA with no detectable UVB or UVC are frequently used to set the varnish.

UVA is long wavelength; also used in tanning beds, it penetrates into the dermis unlike UVB which is largely absorbed in the epidermis.

Tanning beds are classified as carcinogenic by the World Health Organisation, in the same risk category as asbestos and tobacco. This provoked our interest in establishing whether there is a quantifiable risk of skin cancer from repeated nail lamp exposure.

Literature review revealed difference in opinion as to whether there is a risk of photo-aging and cancerous mutation from repeated use of UVA lamps.

Although cases reported are limited to two,[1] both patients developed squamous cell carcinoma(SCC) of the finger with no risk factors other than UVA exposure from repeated nail lamp use. True incidence is not known as other cases of hand or digit skin cancers may not have been screened for nail lamp use due to lack of understanding of this risk. There are no case reports of subungual melanoma associated with nail lamp use, and a small cadaveric study concluded that only a minimal amount of UVA is able to penetrate the nail plate.[2]

Non-clinical studies analysing irradiance from nail lamps report varying conclusions.

Diffey et al.[3] designed a mathematical model to quantify risk of SCC from nail lamp use compared with sun exposure, and predicted that one SCC would develop per 45,000–400,000 exposures.

Markova et al.[4] studied three UV lamps comparing spectral irradiance with exposure of narrowband UVB used for phototherapy. They concluded that UV nail lamps do not appear to significantly increase lifetime risk of keratinocyte carcinoma. Curtis et al.[5] used dosimeter and spectrometry to evaluate exposure and ascertained that in less than 10 min under a lamp, hands receive an energy dose equivalent to the recommended limit for outdoor workers and recreationalists in the course of a day with potential contribution to cancer risk and photoaging.

These findings were challenged by Dowdy et al.[6], who performed a photobiological safety evaluation of six lamps for hazards of radiation, concluding that there is at most 'moderate risk' from these with 30–130 mins of daily exposure.

Conclusions of studies showing low risk from nail lamps have been extrapolated into popular media resulting in statements that these lamps are entirely safe. In contrast, some tabloid articles claim UVA nail lamps pose 'a huge health risk'. Mixed messages leave the population confused, evidenced by a survey from Bollard et al.: over 50% of respondents were unsure as to risk from UVA lamps, but over 80% would avoid use if there was evidence to that effect.[7]

The plastic surgery community use media to alert the population to risk and how to avoid it; for example recent BAPRAS, BSSH and BAAPs strategies to raise awareness regarding firework safety, 'Avocado Hand', and dog lead injuries, as well as a responsible approach to promoting informed decisions surrounding cosmetic surgery. As yet there have been no official media presentations regarding UVA emission from nail lamps.

The evidence base is limited. Published studies involve small numbers, and most rely on non-clinical evaluation of theoretical risk using photodynamic studies, which are challenging for clinicians to extrapolate to true clinical risk. Strong conclusions cannot be drawn from limited analyses.

Although exposure is less than from tanning beds, it is not possible to say there is 'no risk' of skin cancer from frequent use of UVA nail lamps, which are available online and are marketed in a way that is attractive to children and teens. Strength of UVA emissions is variable and the lamps are available for home purchase from retailers such as Amazon and Argos for as little as £11 without product specific age restriction. Accounts for these websites can be opened by customers as young as 13 years old. Some lamps are even labelled 'no harm to hands'.

We acknowledge that reaction to UVA exposure depends on dose, site and skin type. However, UV radiation exposure is responsible for the majority of skin cancers and greater duration and intensity of exposure increases risk. Our ageing population has growing opportunity to accumulate environmental damage to DNA over time, with additional UVA exposure further compounding existing host related risk factors. We find it difficult to accept the stance from some authors that 'low risk' is so negligible that it should be ignored.

Reasonable recommendations include sunscreen application 30 min before lamp use [5] and provision of UV protective gloves[3] in salons. We suggest also that sale of home lamps should be age restricted with warning stickers and safely standardised UV. This may reduce risk of malignancy as well as photoaging and its adverse cosmetic effects, and allow customers to make informed choices.

Declaration of Competing Interest

None.

References

1. MacFarlane DF, Alonso CA. Occurrence of nonmelanoma skin cancers on the hands after UV nail light exposure. *Arch Dermatol* 2009;**145**(4):447–9.
2. Stern DK, Creasey AA, Quijije J, Lebwohl MG. UV-A and UV-b penetration of normal human cadaveric fingernail plate. *Arch Dermatol* 2011;**147**(4):439–41.
3. Diffey BL. The risk of squamous cell carcinoma in women from exposure to UVA lamps used in cosmetic nail treatment. *Br J Dermatol* 2012(5):1175–8.
4. Markova A, Weinstock MA. Risk of skin cancer associated with the use of UV nail lamp. *J Invest Dermatol*. 2013;**133**(4):1097–9.
5. Curtis J, Tanner P, Judd C, Childs B, Hull C, Leachman S. Acrylic nail curing UV lamps: high-intensity exposure warrants further research of skin cancer risk. *J Am Acad Dermatol* 2013;**69**(6):1069–70.
6. Dowdy JC, Sayre RM. Photobiological safety evaluation of UV nail lamps. *Photochem Photobiol* 2013;**89**(4):961–7.
7. Bollard SM, Beecher SM, Moriarty N, Kelly JL, Regan PJ, Potter SM. Skin cancer risk and the use of UV nail lamps. *Australas J Dermatol* 2018;**59**(4):348–9.

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Authorship in surgical articles

Dear Sir,

Many question the validity of authorship allocation, with studies confirming an increasing number of authors per article in surgery over time, particularly in plastic surgery.[1] Several factors have been attributed to this, including increased complexity and collaborations, and the inherently competitive nature of the speciality, rendering publications a necessity in the curriculum vitae.[2] Cynics have suggested that 'guest authorship', inclusion of an individual not meeting the authorship criteria, is a contributory factor secondary to the pressures of 'publish or perish'.

Authorship order is an issue of further contention.[3] Most journals have authorship guidelines for inclusion stating that 'authorship credit should be based only on substantial contribution to conception and design, or analysis and interpretation of data; drafting of the article and revising it critically and for approval' as proposed by *COPE (Committee of Publication Ethics)*. However, there is no such guideline on author ordering. Convention is to have a relatively junior member of staff listed first and the senior member of staff last. The role of the junior author will usually be data collection and manuscript preparation, whereas the senior author delivers the intellectual property, having described and performed the procedure on numerous occasions. The order of authorship rather than contributorship is often used as a surrogate marker of prestige, with implications for research awards at both a unit and individual level. An additional role of the senior author is often to be listed as the corresponding author. The onus therefore falls upon the senior author to not only describe the procedure, but also to take responsibility for the contents, criticism and comments. The additional burden of this role is not rewarded by conventional citation behaviours in which the 'first author, et al' is used.

Some argue that medical journals should adhere to a formula that links the order of authorship explicitly to the extent of contributorship to better reflect individual efforts[4] or that author ordering should even be abolished.[5] How do we assess contributorship? Which holds more value: conceiving and repeating a novel approach with consistently excellent results or dedicating hours to analysing the outcomes, literature and drafting the final manuscript?

A sociocultural paradigm shift in authorship norms has occurred with the passing of time. In the Shakespearean era, strikingly little literature or musical composition carried more than one signature, and similarly in art it is only the master's signature that prevails in the corner, despite contributions from unidentified studio hands. Collaboration in surgical research is key to progression and innovation, and it is advisable to have an open discussion between all authors to determine roles and author order at the outset. Educating both the younger and older generation of surgeons and scientists is vital in enforcing an authorship that mirrors contribution. Although several 'senior' authors do position themselves first, there is a strong logical argument for this to be convention and would represent a more accurate citation in published literature.

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References

1. Durani P, Rimouche S, Ross G. "How many plastic surgeons does it take to write a research article?" – authorship proliferation in and internationalisation of the plastic surgery literature. *J Plast Reconstr Aesthet Surg* 2007;**60**:956–7.
2. Whitaker IS, Chahal CA, Leon R, Baxter P, Sharpe DT. Gain-

ing entry into plastic surgical training in the United Kingdom: a comparative study with orthopedics and otolaryngology. *Ann Plast Surg* 2006;**56**(6):696–8. [cited 2019 Oct 14]Available from: http://www.ncbi.nlm.nih.gov/pubmed/16721090.
3. Riesenberg D, Lundberg GD. The order of authorship: who's on first? *JAMA* 1990;**264**(14):1857. [cited 2019 Oct 14]Available from:http://www.ncbi.nlm.nih.gov/pubmed/2402047.
4. Chambers R, Boath E, Chambers S. The A to **Z** of authorship: analysis of influence of initial letter of surname on order of authorship. *BMJ* 2001;**323**(7327):1460–1 [cited 2019 Oct 14]Available from:. doi:10.1136/bmj.323.7327.1460.
5. Kiser GL. No more first authors, no more last authors. *Nature* 2018;**561**(7724):435. [cited 2019 Oct 14]Available from:http://www.ncbi.nlm.nih.gov/pubmed/30254358.

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How many manuscripts: An analysis of medical student publications in the integrated plastic surgery match

Dear Sir,

Integrated plastic surgery positions are consistently sought after with 234 applicants applying to 172 spots in the 2019 Match.[1] Program directors have consistently rated research as one of the most important factors when deciding which candidates to interview and rank in the National Resident Matching Program (NRMP) Program Director Surveys from 2012 to 2018.[2] Each year, the NRMP releases an annual open-access dataset called "Charting Outcomes in the Match" (ChOM) delineating various metrics of matched applicants. This dataset does not discriminate between abstracts, posters, presentations, and publications, which may not all be equally weighted in terms of importance to residency program directors. The authors aim to provide more in-depth information about the true number of manuscripts published by medical students who applied to integrated plastic surgery residency programs.

The Doximity Residency Navigator was used to sort integrated plastic surgery residency programs by reputation. PGY1 through PGY3 residents from the top and bottom 25 integrated plastic surgery residency programs were included in the analysis. Resident information was collected from the associated program's website. Programs that did not list residents' names or provided outdated information were excluded. The name of each resident was searched on PubMed and the number of manuscripts published before September 15th of their associated application year was determined. Each resident's identity was verified by looking for known affiliated institutions and/or coauthors as listed in the residency program website, LinkedIn, or ResearchGate. The total number, number of first author, number of second author, and number of plastic surgery focused publications were recorded. A two-tailed, paired *t*-test was used to determine statistical significance.

292 residents from 44 programs were included in the analysis (Table 1). Residents at the higher-ranked programs (3.31 ± 4.26) published statistically more PubMed indexed manuscripts than residents at the lower-ranked programs (1.41 ± 2.03, $p < .001$). 15 residents applied with 10 or more PubMed indexed manuscripts and 89 applied with 0 (Figure 1).

The ChOM 2018 report stated that the average plastic surgery matched applicant had a combined 14.2 abstracts, posters, presentations, and publications, which is measurably higher than our investigated average of indexed manuscripts. Our data provides more specific information about the average number of publications for interested medical students and plastic surgery mentors. Results are similar to those found by recent investigations of peer-reviewed publications by neurosurgery and orthopaedic applicants.[3,4] The reporting methodology by the NRMP may lead to unnecessary stress for applicants interested in plastic surgery. Strong applicants may be dissuaded from pursuing their specialty of interest because of this artificially inflated data. To further compound the problem, one manuscript can be turned into four research items if it is presented at multiple conferences, published as an abstract, and subsequently published in a journal. Students may feel that this practice is necessary to obtain this higher number of research items.

The NRMP should report research items separately to eliminate this issue. Additional investigation is necessary to better understand the individual value placed on publi-

Table 1 Average statistics for current PGY-1, PGY-2, and PGY-3 plastic surgery residents for corresponding match year.

Resident year	# of residents	Avg. # of publications	Average # in plastic surgery journals	Average # of first authors	Average # of second authors
PGY-1	103	2.54	0.77	0.76	0.53
PGY-2	94	2.61	1.35	0.85	0.77
PGY-3	95	3.09	1.17	1.14	0.80
Total	292	2.74	1.09	0.91	0.70

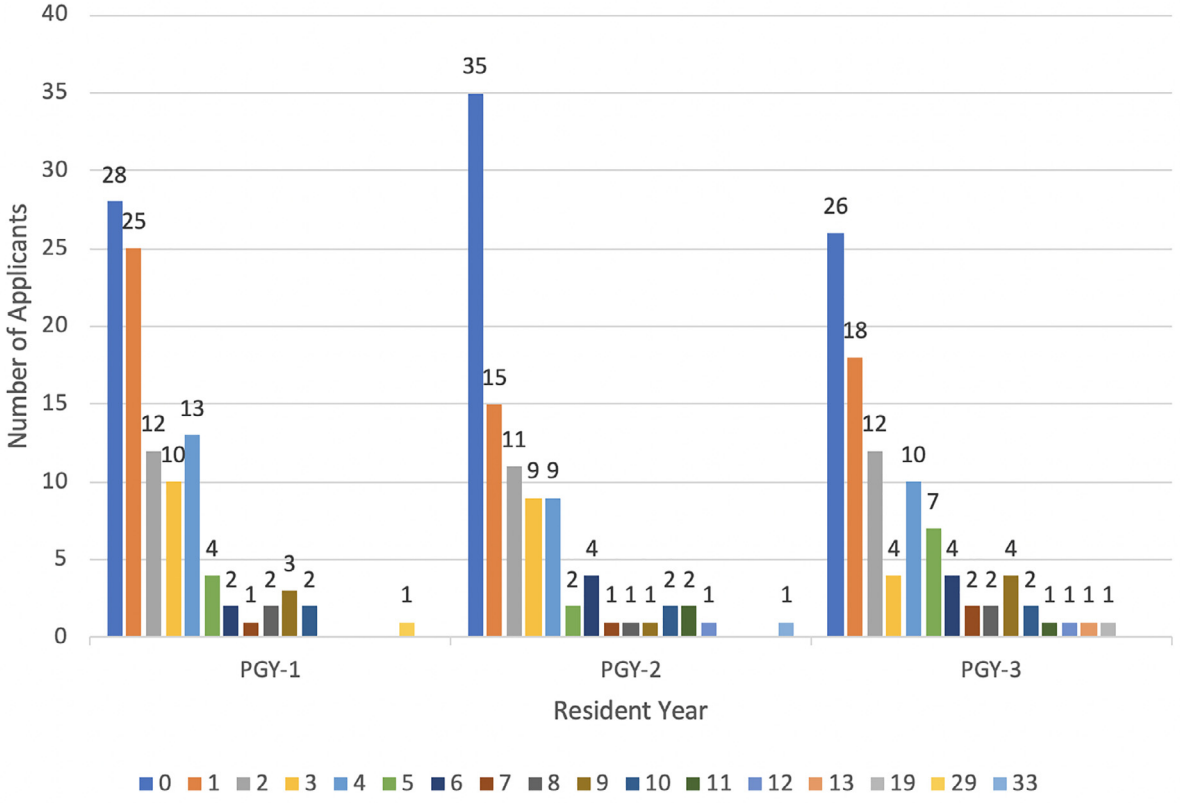

Figure 1 Breakdown of number of applicants who applied to the main residency match by number of publications for each resident year.

cations, presentations, posters, and abstracts by program directors.

Declaration of Competing Interest

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References

1. National Resident Matching Program. *Results and data: 2019 main residency match®*. Washington, DC: National Resident Matching Program; 2019.
2. National Resident Matching Program. *Data release and research committee: results of the 2018 NRMP program director survey*. Washington, DC: National Resident Matching Program; 2018.
3. Wadhwa H, Shah SS, Shan J, et al. The neurosurgery applicant's "arms race": analysis of medical student publication in the Neurosurgery Residency Match. *J Neurosurg* 2019:1-9.
4. Campbell ST, Gupta R, Avedian RS. The effect of applicant publication volume on the orthopaedic residency match. *J Surg Educ* 2016;**73**:490-5.

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Comment upon "Treatment of finger degloving injury with acellular dermal matrices: Functional and aesthetic results"

Dear Sir,

We read with great interest the article in the Journal of Plastic, Reconstructive & Aesthetic Surgery (2019) 72, 1509–1517 «Treatment of finger degloving injury with acellular dermal matrices: Functional and aesthetic results» by Maruccia et al.[1] Although we agree with the authors about the utility of acellular dermal matrices (ADMs) in FDI (finger degloving injuries) we found in our experience that the chemo-physical structure of these matrices can affect the functional and aesthetic outcome in skin substitution.

In their article the authors described the formation of granulation tissue with the use of PELNAC® a template that consists of porcine tendon-derived atelocollagen sponge layer and a silicone layer. The appearance of granulation tissue is the healing process in a wound where the papillary dermis is lost, that bring healing by phenomena of contraction and not of regeneration.

An ideal dermal substitute should be able to create a neodermis with patterns of collagen arrangement like normal skin. In particular a dermal substitute matrice should have a pore size between 20 and 125 mm, a degradation time of 3-4 weeks and a specific surface biology of collagen scaffold in particular the ligand densities that exceed 200 μM $\alpha1\beta1$ or $\alpha2\beta1$ ligands and the presence of other macromolecules (glycosaminoglican) that affect the stability of matrices.[5]

In last years a new differrentiation between AWRs has been described. In one group there are the dermal substitutes biomaterials that act as scaffold, they are colonized by host cells and replaced by biologically regenerated dermal tissue with a controlled degradation and on the groups the bioinductors that are biomaterials that may have a scaffold-like structure whose methabolic role is to stimulate the generation of granulation tissue and they have a non-controlled degradation.

In a vitro study of Hori et al.[2] they made a comparison between three dermal substitutes Pelnac® Integra® and Terudermis®. They concluded that Pelnac in vitro has a higher contraction rate compared to the one of Integra. They also showed that the pore size of Pelnac was smaller than that of Integra and that the oval shape of pores of Pelnac may cause contraction of this AWR. While Integra 's scaffold structure did not show contraction throughout the experiments. They also showed that the pore size of Pelnac was smaller than that of Integra and Terudermis.

The shape of the pore was oval in Pelnac, whereas those in Integra were more circular. Differences in the morphological structure affected the contraction of the dermal substitutes. For the authors Integra seems to be suitable for preventing wound contraction for its physical structure while Pelnac should cause contraction and bring to shrink scar.

Moimen et al.[3] described in a long-term clinical and histological study where show that Integra dermal regeneration template bring to the formation of neodermis and significant improvements in patient-assessed mobility, softness, and appearance.

In other publications on using of AWMs in hands deglovings such as Weigert et al.[4] use Integra® a dermal regeneration template composed of a silicone layer and a collagen sponge of bovine collagen and glycosaminoglican (chondroitin sulfate). The authors in this study show that Integra® dermal regeneration template creates a neodermis that has physical characterists similar to normal skin. The evidence of neodermis is judged with the formation of an orange/peachy or vanilla colour tissue under silicone layer. The formation of neodermis makes a better functional outcomes with a better range of motion and grip strength of the fingers.

We want underline that in the study of Maruccia et al. the patients with FDI with tendon apparatus injury and/or bone exposed were excluded.

One of the most important characteristics of an AWR is to be able to create neodermis on poorly vascularized wound beds.

Taras[5] and colleagues described their experience with Integra on 17 patients with digital injuries, associated with tendon, bone and joint exposure. Integra IDRT showed to be effective in create neodermis in poor vascularized wound beds.[6]

Even in our experience with Integra we can confirm that Integra leads a formation of a neodermis with good functional and aesthetic outcomes even on tendons and bones.

We can conclude that there are dermal substitutes such as Integra that brings to neodermis and bionductors such as Pelnac that brings to formation of a granulation tissue a more contracted scar that can reduce the range of motion of fingers and joints.

We suggest that nowadays a differentiation in regenerative medicine between dermal substitutes and bioinductors has to be created.

Declaration of Competing Interest

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References

1. Maruccia M, Marannino PC, Elia R, et al. Treatment of finger degloving injury with acellular dermal matrices: functional and aesthetic results. *J Plast Reconstr Aesthet Surg* 2019;**72**(9):1509–17 Epub 2019 May 22. doi:10.1016/j.bjps.2019.05.029.
2. Hori K, Osada A, Isago T, Sakurai H. Comparison of contraction among three dermal substitutes: morphological differences in scaffolds. *Burns* 2017;**43**(4):846–51.
3. Moiemen N, Yarrow J, Hodgson E, et al. Long-term clinical and histological analysis of integra dermal regeneration template. *Plast Reconstr Surg* 2011;**127**(3):1149–54. doi:10.1097/PRS.0b013e31820436e3.
4. Weigert R, Choughri H. Casoli management of severe hand wounds with integra® dermal regeneration template. *Hand Surg Eur Vol* 2011;**36**(3):185–93. doi:10.1177/1753193410387329.
5. Taras JS, Sapienza A, Roach JB, Taras JP. Acellular dermal regeneration template for soft tissue reconstruction of the digits. *J Hand Surg* 2010;**35**(3):415–21.
6. Magnoni C, Campitiello F, Papa G., et al. Gare di appalto per le matrici acellulari dermiche: proposta per l'individuazione di score di qualità/Tendering for dermal acellular matrices: proposal for the identification of quality scores. Ital J Wound Care, 2(2). doi:10.4081/ijwc.2018.32.

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Re "Endoscopic retrieval of retracted flexor tendons: An atraumatic technique"

Dear Sir,

We read with great interest the report by Kucukguven et al. on their experience with endoscopic tendon retrieval[1]. The use of endoscopy in hand surgery has progressed from cadaveric studies[2,3] to tendoscopy[4] and tendon retrieval.

Zone two flexor tendon repairs are challenging, particularly when dealing with retracted tendons. This is especially the case for flexor pollicis longus (FPL) when the tendon retracts behind the thenar musculature. Most hand surgeons are accustomed to using proximal incisions to retrieve the tendon[5]. This involves an additional wound, increased surgical time and a potentially unsightly scar amongst the risk of other complications.

We have been keen to employ endoscopic retrieval for some time however, we have been hampered by the cost, size, availability and complexity of scopes in addition to sterility issues. The availability of new disposable endoscopes has brought about a potential solution to these problems. We would like to share our in vivo proof of concept case where we used a 3.8 mm Ambu® aScope™ (Ambu A/S, Ballerup, Denmark) to examine and retrieve a retracted FPL tendon. This disposable endoscope is used by anaesthetists and intensivists for bronchial lavage and percutaneous tracheostomy procedures. It has a small, easily portable screen and does not require an endoscopic "stack", making it logistically much more practical for the hand surgeon and theatre staff unaccustomed to endoscopic surgery.

A patient with a zone two FPL tendon division underwent wound exploration under general anaesthetic. The tendon was found to have retracted into its sheath behind the thenar muscles, and despite adjunct manoeuvres such as milking and wrist flexion, the tendon could not be delivered into the wound. The Ambu® aScope™ was used to retrieve the tendon without the need for a proximal incision or would extension beyond that needed for the repair. Endoscopic forceps were not available however, by using irrigation and suction through the endoscope we managed to dislodge and retrieve the tendon end. This avoided the need for a proximal incision, reducing the overall operating time needed as minimal setup was required. The cost of the scope is £180 GBP, which makes it cheaper than the theatre time required for conventional surgery.

There are some limitations with the Ambu® aScope™. Firstly, the smallest disposable endoscope available has a diameter of 3.8 mm, which limits its use to only larger hands/tendons. Additionally, we found it difficult to focus the camera within the tendon sheath. Nonetheless, we found the process relatively straightforward.

In summary, the use of disposable endoscopes for tendon retrieval reduces set up costs for plastic surgery units to almost zero and eliminates all worries about decontamination of reusable scopes. Additionally, new smaller diameter single-use flexible uretoroscopes such as YC-FR-A (YouCare Tech, China) or NeoFlex (Neoscope, Inc., USA) might significantly increase uptake of this method once they have achieved CE marking.

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References

1. Kucukguven A, Uzun H, Menku FD, Sert G, Aksu AE. Endoscopic retrieval of retracted flexor tendons: An atraumatic technique. *J Plast Reconstr Aesthetic Surg* 2019;**72**(4):622–7.
2. Hill BB, Wells MD, Prevel CD. Endoscopic retrieval of severed flexor tendons: A study of technique using cadaveric hands. *Ann Plast Surg* 1997;**38**(5):446–8.
3. Li KM, Banducci DR, Kahler SH, Hauck RM, Mackay DR, Manders EK. Endoscopic retrieval of severed flexor tendons. *J Hand Surg Am* 1995;**20**(2):278–9.

4. Lui TH. Flexor pollicis longus tendoscopy. *Arthrosc Tech* 2017;**6**(1):e249–54.
5. Wong J, McGrouther DA. Minimizing trauma over "no man's land" with flexor tendon retrieval. *J Hand Surg: Eur Vol* 2014;**39**:1004–6.

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Re: The muscle sparing latissimus dorsi (MSLD) flap for secondary breast reconstruction based on reverse flow from intercostal vessels

Dear Sir,

It was with great interest that we read Sakharpe et al.'s recent paper entitled 'The muscle sparing latissimus dorsi (MSLD) flap for secondary breast reconstruction based on reverse flow from intercostal vessels'.[1] It is certainly true that secondary breast reconstruction can be challenging, particularly where traditional vascular territories have been compromised for workhorse flap options.

The development of MSLD flaps, as described by Tobin et al.[2] offer a valuable opportunity to minimise the latissimus dorsi (LD) donor morbidity, targeting dissection of the LD to include either descending or horizontal branches of the muscle along with their perforators. Saint Cyr et al.'s further modification to include a horizontal skin paddle enables a greater volume harvest and the recruitment of fresh skin.[3]

The challenge in your paper, namely the ligation of the thoracodorsal axis, would certainly have inadvertently induced the delay phenomenon through the opening of choke vessels, expanding the vascular territory of the segmental perforators supplying the LD. The assertion that you make in your paper is that the myocutaneous island you describe is supplied by 'reverse flow' from the intercostal vessels. We suggest that this might be inaccurate; this flow is almost certainly antegrade, particularly if the segment of muscle illustrated is transposed laterally. The LD flap is known to survive based entirely on its segmental secondary vessels where the dominant thoracodorsal pedicle is divided, proving the anatomical basis for a variety of turn-over flaps. That the vascular supply interdigitates with the thoracodorsal vessels distal to the clips is not surprising given both the increasing arborisation of more distal vasculature and the induced delay, so utilising all available vascular channels to aid perfusion. The presence of collateral flow from the thoracodorsal axis might also be considered possible in the context of inadequate or incomplete perfusion from the segmental perforators.

Certainly what is of great interest in this report is the application of this flap and the rationale for its use over a range of other flaps. It wasn't clear whether this was a pedicled or free flap; if this was a pedicled flap, it would appear that the arc of rotation for inset would be limited, with more extensive release compromising the flap's collateral supply. Furthermore, the position of the pivot point in the muscle would result in a lateral fullness positioned quite low on the patient's lateral chest, something we see patients have problems with. Our experience of distally-based skin paddles suggests that whilst they can easily be harvested, they are more prone to congestion than more cranially-placed paddles. Our aims in free flap-based breast reconstruction guide us towards the use of flaps with long vascular pedicles (to make access for the anastomosis as simple as possible) with wide calibre vessels (again, to optimise the anastomosis and flow of blood both into and out of the flap). Understanding how this flap based on smaller intercostal or lumbar perforators is superior to other locoregional or free fasciocutaneous flaps based on other vascular axes or on intercostal perforators would be helpful.

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Declaration of Competing Interest

None.

References

1. Sakharpe K, Cook J, Newman M, Barnavon Y. The muscle sparing latissimus dorsi (MSLD) flap for secondary breast reconstruction based on reverse flow from intercostal vessels. *J Plast Reconstruct Aesthet Surg* 2019(19):S1748–6815 pii30261-X.
2. Tobin GR, Moberg AW, DuBou RH, Weiner LJ, Bland KI. The split latissimus dorsi myocutaneous flap. *Ann Plast Surg* 1981;**7**(4):272–80.
3. Saint-Cyr M, Nagarkar P, Schaverien M, Dauwe P, Wong C, Rohrich RJ. The pedicled descending branch muscle-sparing latissimus dorsi flap for breast reconstruction. *Plast Reconstr Surg* 2009;**123**(1):13–24.

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Response to letter: The muscle sparing latissimus dorsi (MSLD) flap for secondary breast reconstruction based on reverse flow from intercostal vessels

Dear Sir,

We appreciate the comments and questions from Harborough et al.[1] and welcome the opportunity to respond. First, we would like to clarify that the cases we presented were all pedicled muscle sparing latissimus dorsi flaps (MSLD). All cases presented in our letter had interruption of the dominant thoracodorsal artery (TDA) blood supply, just proximal to the muscular branch to the latissimus dorsi (LD) muscle. In all cases, the serratus branch was either clipped or absent (Figure 1(A) of the initial letter).[2] Due to these circumstances, antegrade flow through the dominant muscular branch was unlikely.

Although turn-over flaps are well described via antegrade intercostal blood flow, this configuration would not be possible in our presented cases. In our published technique for raising the MSLD flap[3] we leave only a 5-8 cm wide strip of lateral LD muscle centred on the descending muscular branch of TDA in direct contact with skin paddle of the flap (Figure 1(B)). The muscle is then divided distally to proximally until the TDA bifurcation is reached, which disrupts all segmental intercostal perforators to the lower medial portions of the muscle (Figure 1(C)). Additionally, by limiting the amount of muscle removed to a central strip surrounding the pedicle, we have not encountered the lateral fullness noted by the authors in the axilla.

The point of rotation of the MSLD flap is at the bifurcation of the muscular artery into its transverse and descending branches. Even though this lowers the point of rotation by around 5 cm,[4] in our experience we have not encountered difficulty having the distal end of the skin paddle reach the medial portion of a mastectomy defect. In fact, the horizontal skin paddle provides enough available skin that we typically have to debride zone 3[5] so as not to extend past the medial portion of the breast footprint. Adequacy of this flap is demonstrated in our post-operative picture (Supplementary Figure 1(C) and (D) of our initial letter), in which the left breast was reconstructed with the reverse flow MSLD flap. Our senior author YB has now performed 4 cases where the reverse flow MSLD flap reconstruction was used, and all flaps have reached their intended defects using pedicled reconstruction. YB also has the largest published series of pedicled MSLD flaps for breast reconstruction[2] and has not encountered difficulty with medial coverage.

The pedicled MSLD flap is our preferred flap for patients who are not candidates for free flaps (or who refuse autologous reconstruction). YB has performed more than 200 flaps at the time of this writing, and we feel comfortable using ICG angiography sparingly when assessing these flaps intraoperatively. However, we did perform ICG angiography routinely in our earlier flaps, and it demonstrated robustness of skin paddle perfusion at the time of surgery. Long-term data from our retrospective analysis is also available.[3,5] As far as venous congestion is concerned, we do notice it in the early post-operative phase, but this resolves fairly quickly. Our perfusion zones and flap planning can be seen in our previous publication.[3,5]

Given the data we have published and continue to gather, we believe the MSLD should be the workhorse pedicled flap for breast reconstruction. The goal of our letter to the editors was not to debate the utility of the pedicled MSLD, which we believe has been established, but instead to re-

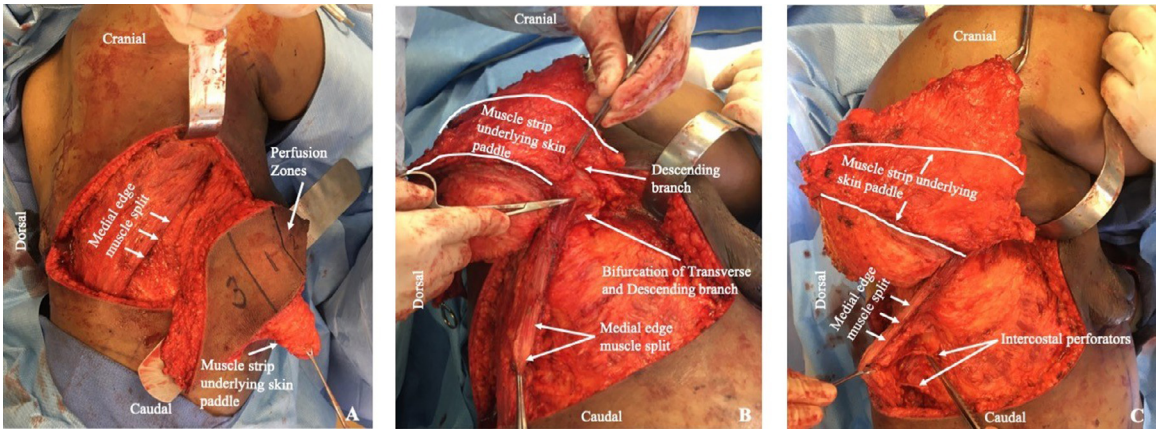

Figure 1 (A) Perfusion zones 1, 2 and 3 and split LD muscle; (B) division muscle till bifurcation of muscular branches; (C) lower Intercostal perforators without connection to pedicled flap.

port to the readers that performing MSLD flap for secondary breast reconstruction is still possible after encountering a ligated dominant TDA pedicle proximal to the LD muscle.

Declaration of Competing Interest

Dr. Sakharpe has nothing to disclose. Dr. Cook has nothing to disclose. Dr. Newman is a paid consultant and speaker for the Novadaq. Dr. Barnavon has nothing to disclose.

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None.

Ethical approval

Not required.

References

1. Harborough KE, Hurley AR, King ICC. Re: The muscle sparing latissimus dorsi (MSLD) flap for secondary breast reconstruction based on reverse flow from intercostal vessels. *J Plast Reconstr Aes* 2020 In Press.
2. Sakharpe AK, Cook J, Newman M, Barnavon Y. The muscle sparing latissimus dorsi (MSLD) flap for secondary breast reconstruction based on reverse flow from intercostal vessels. *J Plast Reconstruct Aesthet Surg* 2019;**73**(1):184–99. pii: S1748-6815(19)30261-X.
3. Cook J, Waughtel J, Brooks C, Hardin D, Hwee YK, Barnavon Y. The muscle-sparing latissimus dorsi flap for breast reconstruction: a retrospective review of 126 consecutive flaps. *Ann Plast Surg* 2017;**78**(6S Suppl 5):S263–8.
4. Schaverien M, Wong C, Bailey S, Saint-Cyr M. Thoracodorsal artery perforator flap and latissimus dorsi myocutaneous flap-anatomical study of the constant skin paddle perforator locations. *J Plast Reconstruct Aesthet Surg* 2010;**63**(12):2123–7.
5. Koonce SL, Barnavon Y, Newman MI, Hwee YK. "Perfusion zones of extended transverse skin paddles in muscle-sparing latissimus dorsi myocutaneous flaps for breast reconstruction. *Plast Reconstruct Surg 143* 2019;**5**:920e–926e.

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Re: The "Dermal Cage": Inferiorly based dermal flap technique for breast reconstruction after mastectomy

Dear Sir,

We read the article by Vlajcic et al. entitled, 'The "Dermal Cage": Inferiorly based dermal flap technique for breast reconstruction after mastectomy'[1] with great interest. The task of providing adequate support and tissue cover for implant-based reconstruction can be challenging.

Vlajcic et al. describe a technique wherein an inferior dermal sling is modified such that the medial and lateral 'wings' are developed to allow their fixation to the chest wall around an implant. They describe that these wings should be 1–2 cm thick and that the thickness of the inferior dermal sling should be no thinner than 1 cm thickness to preserve the inferior pedicle. Further, they plicate the lower part of the inferior pedicle which supports an islanded nipple areola complex.

Whilst this technique is certainly novel, a number of aspects of the approach bear further examination. Previous descriptions of dermal flap reconstructions[2,3] all describe the use of deepithelialised lower pole mastectomy flaps to provide support to implant-based reconstruction. In all descriptions, the base of these flaps is left broad with the understanding that the tissue envelope survives solely on the vascular supply from the inferiorly-based dermal and subdermal plexi. The inferior pedicle is the mainstay of breast reduction in many parts of the world; typically arising from either the 5th or 6th intercostal space, entering the breast just medial to the breast meridian. In a standard and uniform mastectomy, this is typically encountered and divided during the course of the dissection. It is unusual in our experience to encounter mastectomy flaps thicker than 1 cm, which is fundamental to this technique. Oncological clearance of breast tissue should be the priority in both prophylactic and therapeutic mastectomies; to compromise this for the reconstruction seems unwise, certainly when considering the thickness of the dermal wings required for this technique. Indeed, Giannotti et al.[4] demonstrated in nipple sparing mastectomy that with a minimal flap thickness of even 5.5 mm (average flap thickness throughout the study of 9.6 mm) significant residual breast tissue may remain after surgery. Certainly concern regarding residual tumour might lead to the requirement for further management with adjuvant therapy/radiotherapy, which is certainly not desirable for implant-based reconstruction.

The reliability of the skin flaps' vascularity is understandably a concern with this design. Liberating the wings narrows the vascular base of the flap significantly; so the narrowed and thinned dermal bridge then must support the dermal wings and nipple areolar complex which are critical to the reconstruction. Perhaps the dermal wings support the implants through fibrosis if their intended vascular support for the implants is compromised. The authors report no NAC loss despite the illustrations demonstrating that these nipples can struggle and indeed can be lost at least in part; certainly such a narrow vascular pedicle is being asked to do a great deal. Free nipple grafting in such circumstances is sometimes preferable.[5]

Furthermore, base width is a vital component in breast implant selection to produce a breast which both sits well on and is proportionate to the patient's chest. Placement of these dermal wings onto the chest wall narrows the base width of the breast significantly having an impact upon the implants which can be placed within the pocket. Inevitably if the reconstruction is based on the mastectomy volume but width is reduced, projection or height will have to be increased to facilitate this volume requirement. How these either age, change shape after radiotherapy or can be matched with symmetrising procedures is unclear.

This technique is interesting but the compromise in inferior dermal pedicle flap vascularity (along with the NAC) and the impact on breast base width and therefore shape are significant considerations. The inferior dermal sling is well-described and widely used because of its reliability; certainly any modifications of this should not compromise on oncological safety, which lies at the heart of our patient care.

Declaration of Competing Interest

None.

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None.

References

1. Vlajcic Z, Martic K, Budi S, Roje Z, Dewing D, Zic R. The "Dermal Cage" – Inferiorly based dermal flap technique for breast reconstruction after mastectomy. *J Plast Reconstr Aesthet Surg* 2019. doi:10.1016/j.bjps.2019.09.021.
2. Tanski EV. A new method for prophylactic mastectomy, reduction mammaplasty, and mastopexy. *Plast Reconstr Surg* 1980;**65**(3):14–22 Mar.
3. Bostwick J. Prophylactic (risk-reducing) mastectomy and reconstruction, In: Bostwick J. (Ed.) Plastic and reconstructive breast surgery, Vol II. Quality Medical Publishing, St. Luis, pp 1369–1373.
4. Giannotti DG, Hanna SA, Cerri GG, Barbosa Bevilacqua JL. Analysis of skin flap thickness and residual breast tissue after mastectomy. *Int J Radiat Oncol Biol Phys* 2018;**102**(1):82–91.
5. King IC, Harvey JR, Bhaskar P. One-stage breast reconstruction using the inferior dermal flap, implant, and free nipple graft. *Aesthet Plast Surg* 2014;**38**(2):358–64.

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