

ORIGINAL ARTICLE **AESTHETIC**

Autologous fat grafting: current state of clinical practice in the Australian setting

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Objective

This study aimed to gather and present systemic data about current fat grafting practice in Australia. We knew prior to the study that data for Australian fat grafting is limited, so we sought information from distinct sources. Part one aimed to present fat grafting data available from the Australian Breast Device Registry (ABDR). Part two aimed to present the details of current fat grafting practice by Australian plastic and reconstructive surgeons.

Methods

In part one, fat grafting data from the ABDR from its inception in 2012 to 2020 was collected and summarised. In part two, a comprehensive survey about all aspects of fat grafting practice was distributed to surgeon members of the Australian Society of Plastic Surgeons (ASPS). This study was approved by the Alfred Health Ethics and Research Governance Committee (HERGC 282/21).

Results

Part one: the ABDR recorded an 8.4 per cent and 6.0 per cent increase in fat grafting at the time of breast device insertion surgery from 2012 to 2020 for reconstructive and aesthetic procedures respectively. Fat grafting with breast device insertion, in previously irradiated breast tissue, increased from 0 per cent to 17.4 per cent in the same period. Part two: one in five of all surgeons of the ASPS completed the survey. Our survey demonstrated that fat grafting is highly heterogeneous with respect to donor site selection, harvest technique, processing technique, number of sessions required and volumetric follow-up.

Conclusion

Our study is the first attempt to present national data on fat grafting. It demonstrates clearly that uptake of autologous fat grafting for breast reconstruction and aesthetic procedures is rapidly increasing Australia-wide. It demonstrates that procedural variables of fat grafting are not standardised

among Australian plastic surgeons. This indicates that further clinical data relating to patient demographics, procedural variables and outcomes are vital to ensure patient safety, health resource management and to inform best practice guidelines.

Introduction

Autologous fat grafting (AFG) has become an increasingly used surgical technique in Australia and around the world. It is a popular surgical option for use in an array of reconstructive, aesthetic and other therapeutic applications.

The recent introduction, in November 2021, of Medical Benefits Schedule (MBS) item numbers in the national health insurance scheme (Medicare) for use in AFG to breast, burns scars and craniofacial defects has refocused attention on fat grafting as an important surgical technique.¹ Currently, protocols for best practice are based largely on clinical experience, ad hoc anecdotal evidence or protocols created by commercial entities as a point of differentiation from their competitors.

Despite the variety of broad clinical indications for the use of fat grafting, and an even broader range of clinical techniques described for optimising fat grafting,^{2,3} the practice of clinical fat grafting in Australia has not been characterised. To date, little data has been collected or published on fat grafting in Australia and, therefore, regulators and funding bodies are ill-equipped to assess the scope of practice of surgeons and other practitioners who offer fat grafting to patients. Similarly, it is difficult to establish best practice guidelines or recommendations without first understanding the landscape of the practice within our jurisdiction. Importantly, there has been no attempt so far to characterise the practice among plastic surgeons, who are major proponents of fat grafting. One key aspect of understanding best practice, fat graft success rates and volume retention long term is in the process of providing informed consent that is critical to enable patients to make informed decisions regarding their health expectations and outcomes. It is also imperative to better understand the application of the practice now that funding bodies have accepted the liability of paying for fat grafting procedures in certain patient cohorts.

We conducted the most comprehensive clinical survey to date to assess the scope of clinical practice among plastic surgeons in Australia using a validated survey tool.

This article provides a snapshot of fat grafting practice in Australia today and paves the way for further elucidation of AFG in other professional

groups. Previously, the only attempt made to characterise the practice of fat grafting was a single question within the ABDR. Part one of this paper presents this previously unpublished data from the ABDR. Part two presents the findings from our clinical survey. We hope that this report will provide the foundations for a more comprehensive study and enable Australian peak funding bodies and regulators to understand the ways in which the practice may be both safeguarded for patient welfare and enhanced when scientific evidence for practices that may improve efficacy come to light.

Methods

Part one

Part one aimed to determine the incidence of fat grafting in breast device insertion surgery from a single question included in the Australian Breast Device Registry (ABDR). The ABDR routinely records details of all surgeries involving breast device insertion, including implants, tissue expanders, acellular dermal matrices or mesh products. The ABDR data collection form records fat grafting used in breast implant surgery under 'elements of operation'. This part of the form is completed for all operations involving breast implants or tissue expanders recording AFG used at the time of implant insertion, removal or replacement. Data from 2012 to 2020 were sourced from the ABDR. The primary outcomes were the incidence of fat grafting in reconstructive and aesthetic breast device insertion surgeries and incidence of fat grafting in breast device insertion surgeries in previously irradiated breast tissue. The secondary outcomes were operation type for all breast device insertion procedures recorded with fat grafting and volume of fat injected.

Part two

The survey-based study aimed to characterise current fat grafting practice among Australian plastic and reconstructive surgeons. We designed a 14-point questionnaire asking Australian plastic and reconstructive surgeons about their use of fat grafting, area grafted, indications for grafting, donor site selection, harvest technique, processing technique, use of enzymatic digestion, number of sessions required and postoperative volumetric

Australian Fat Grafting Survey

Thank you for taking part in this survey. The aim of this survey is to formulate a better understanding of the current use of fat grafting by plastic and reconstructive surgeons in Australia. This form may be completed anonymously if preferred.

Completely de-identified results of this survey may be published in future.

[Sign in to Google](#) to save your progress. [Learn more](#)

Participating Surgeon Name (optional):

Your answer: _____

In which state do you primarily practice?

☐ ACT
☐ New South Wales
☐ Northern Territory
☐ Queensland
☐ South Australia
☐ Tasmania
☐ Victoria
☐ Western Australia

Do you use fat grafting?

☐ Yes
☐ No

Which areas do you fat graft?

☐ Breast
☐ Face
☐ Buttock
☐ Other: _____

If you fat graft to the breast, for which indications? (please tick all that apply)

☐ Reconstructive - Contour deformity
☐ Reconstructive - augmentation of autologous tissue
☐ Reconstructive - Contralateral symmetry procedure
☐ Reconstructive - Congenital deformity
☐ Aesthetic - Breast augmentation
☐ Aesthetic - Augmentation to replace implant
☐ Aesthetic - Mastopexy (without implant)
☐ Aesthetic - Contour deformity

If you fat graft to the face, for which indications? (please tick all that apply)

☐ Reconstructive - Congenital
☐ Reconstructive - Secondary contour deformity
☐ Aesthetic

Do you fat graft for these other indications? (please tick all that apply)

☐ Radiation induced soft tissue injury
☐ Burn
☐ Scarring
☐ Other: _____

Which donor site do you most commonly use? (1 most common, 6 least common, please only rank those sites you use)

	1	2	3	4	5	6
Lower Abdomen	☐	☐	☐	☐	☐	☐
Medial Thigh	☐	☐	☐	☐	☐	☐
Lateral Thigh	☐	☐	☐	☐	☐	☐
Flank	☐	☐	☐	☐	☐	☐
Gluteal	☐	☐	☐	☐	☐	☐
Medial Knee	☐	☐	☐	☐	☐	☐
Mixed (if you harvest from mixed sites in a single patient, please tick which sites above)	☐	☐	☐	☐	☐	☐

How do you select donor site? (please tick all that apply)

☐ Random
☐ Habit
☐ Patient preference
☐ Literature
☐ Individual patient adipose distribution
☐ Other: _____

Which harvest technique do you use? (please tick all that apply)

☐ Manual aspiration
☐ Suction-unit assisted aspiration

Which tumescent fluid do you use for fat graft harvest? (please tick all that apply)

☐ None
☐ Normal Saline
☐ Local Anaesthetic
☐ Adrenaline
☐ Other: _____

Which fat processing technique do you use? (please tick all that apply)

☐ Telfa roll
☐ Centrifuge
☐ Decanting
☐ Filter/Strain
☐ Wash
☐ Revolve
☐ Puregraft
☐ Other: _____

Do you use enzymatic digestion to isolate autologous stem cells?

☐ Yes
☐ No

On average, how many fat grafting sessions are required to achieve the desired result?

☐ 1
☐ 2
☐ 3
☐ 4+

Have you performed volumetric analysis of the fat you have grafted?

☐ No
☐ Yes - Ultrasound
☐ Yes - MRI
☐ Yes - Vectra 3D imaging
☐ Other: _____

Fig 1. 14-point questionnaire sent to consultant members of the Australian Society of Plastic Surgeons

analysis (**Figure 1**). The study was conducted between July and December 2021. Surveys were distributed via email to 403 active members of ASPS.

This study was approved by the Alfred Health Ethics and Research Governance Committee (HERGC 282/21).

Results

Part one: Epidemiological data from the Australian Breast Device Registry

The ABDR form records the presence of concomitant fat grafting at the time of device insertion (yes or no) as well as the volume of fat injected. This is currently the only formal method in place for collection of autologous fat grafting data. The proportion of device insertion procedures with fat

grafting increased from 0 per cent in 2012 to 8.4 per cent and 6.0 per cent in 2020 for reconstructive and aesthetic procedures respectively (**Figure 2, a and b**). Fat grafting at the time of breast device insertion in previously irradiated breast tissue has also increased from 0 per cent to 17.4 per cent in the same seven-year period (**Figure 2c**). The mean recorded volume of fat injected in breast device insertions was 61.5mLs for reconstructive procedures and 31.4mLs for aesthetic procedures.

For reconstructive breast surgery, the majority of procedures reporting the use of fat grafting were for implant replacement procedures (42.8%) followed by tissue expander to implant exchange procedures (38.3%). For aesthetic breast surgery, most procedures with fat grafting consisted of first implant insertions (71.2%) and a smaller proportion consisted of implant replacements (22.3%) (**Table 1**).

Table 1. Reported operation type for all breast device (implant and tissue expander) insertion procedures recorded with fat grafting

Fat grafting insertion procedure		
	Reconstructive	Aesthetic
Tissue expander insertion	71 (3.4%)	0 (0.0%)
Tissue expander revision (replacement)	13 (0.6%)	0 (0.0%)
Implant removal and tissue expander insertion	4 (0.2%)	0 (0.0%)
First implant insertion	231 (11.1%)	1726 (71.2%)
Tissue expander removal and implant insertion	797 (38.3%)	21 (0.9%)
Implant revision (replacement)	890 (42.8%)	540 (22.3%)
Implant revision (reposition)	35 (1.7%)	3 (0.1%)
Implant revision (explant)	34 (1.6%)	134 (5.5%)
Total	2079 (100.0%)	2426 (100.0%)

Part two: Fat grafting survey for Australian plastic and reconstructive surgeons

Demographics of respondents

The overall response rate was 21 per cent (84 responses). This response rate carries a 10 per cent margin of error with a 95 per cent confidence interval. Eighty-eight per cent of participants reported 'yes' to the use of fat grafting while 12 per cent reported 'no'. Surgeons from all states and territories were represented: ACT (1.2%), NSW (21.4%), NT (1.2%), QLD (10.7%), SA (4.8%), TAS (2.3%), VIC (53.6%) and WA (4.8%). Victorian representation in the survey was higher than its 30 per cent representation of ASPS members.

Indications for autologous fat grafting

Autologous fat grafting use was reported for 18 indications (Figure 3). All but four of these indications were used by more than 25 per cent of respondents, indicating that AFG is commonly used across a wide range of reconstructive and aesthetic clinical applications.

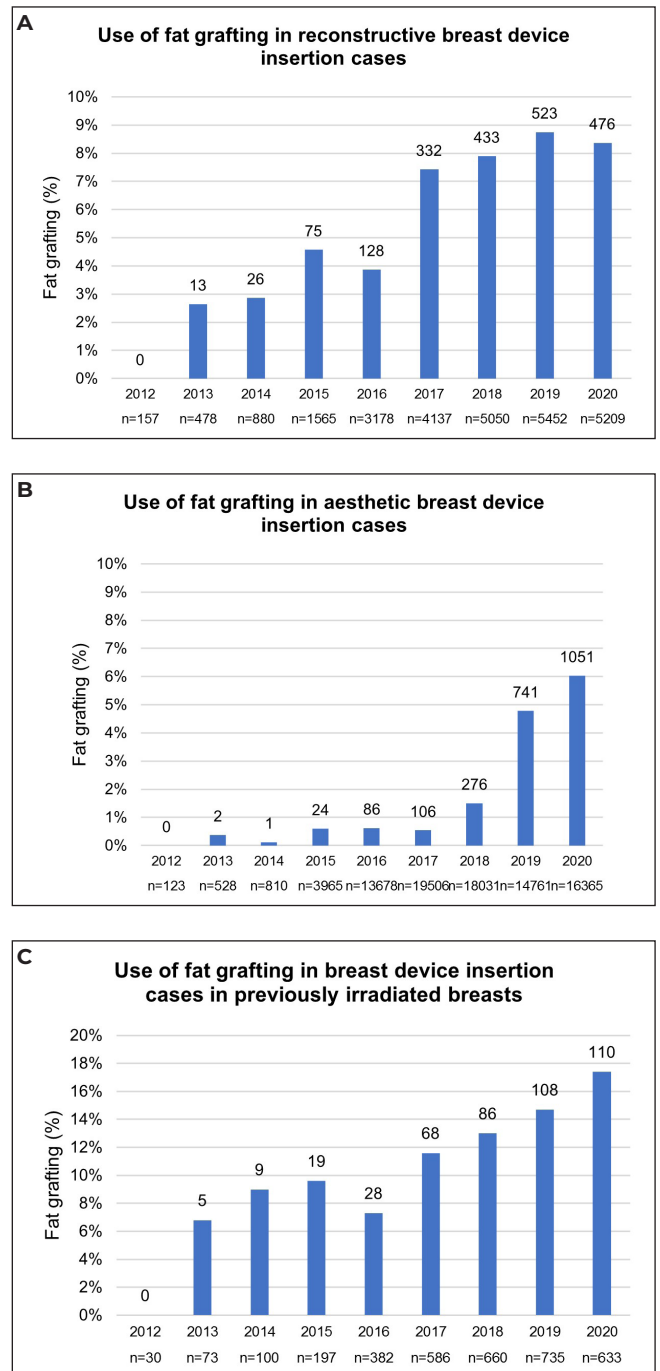


Fig 2. Proportion of breast device insertion procedures recorded with fat grafting: a) reconstructive; b) aesthetic procedures by year of insertion; c) Proportion of previously irradiated breasts that recorded fat grafting at the time of breast device insertion procedure by year of insertion (n = total number of procedures by year, data label = fat grafting procedures by year).

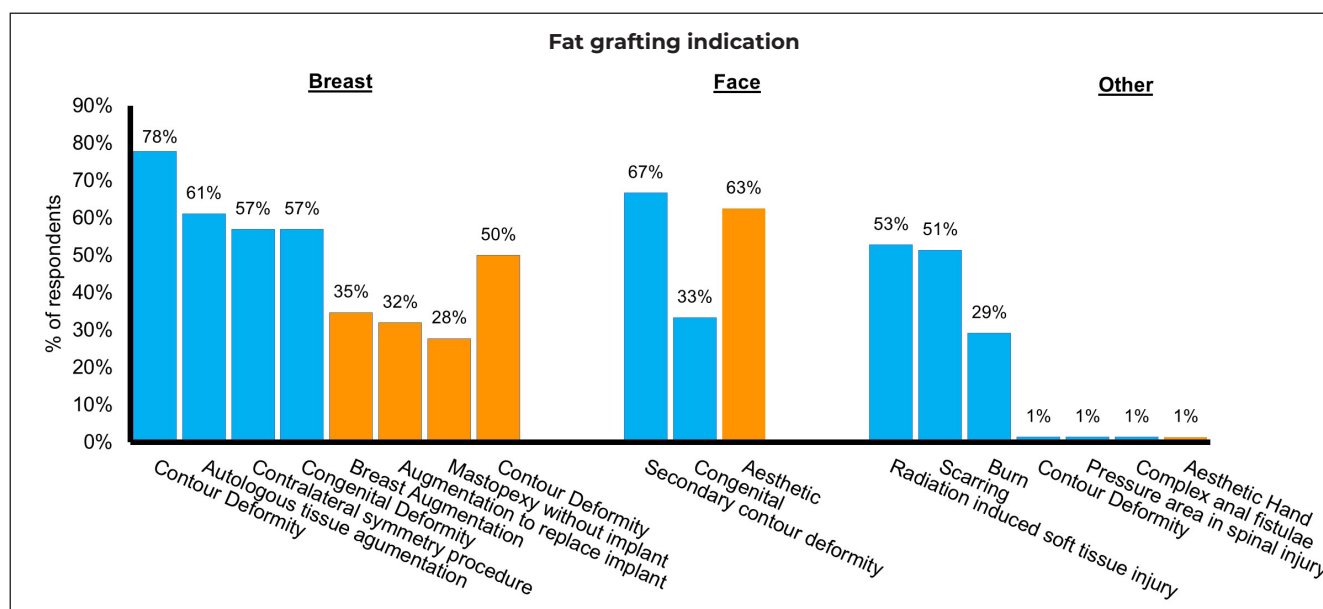


Fig 3. Indications for fat grafting, reconstructive (blue), aesthetic (orange). Percentage of respondents corresponds to those that reported yes to fat grafting.

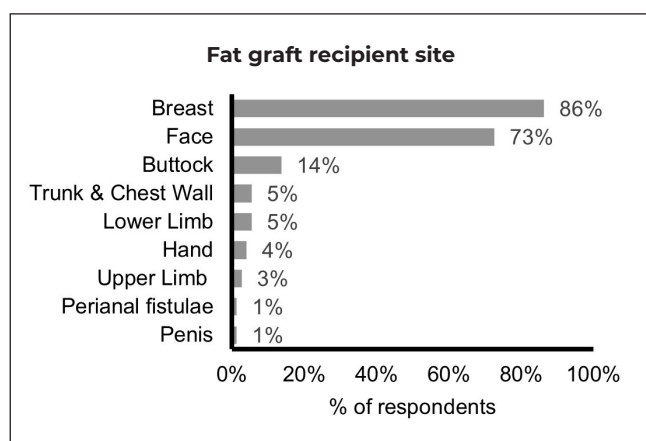


Fig 4. Fat graft recipient sites and the percentage of respondents that graft to each site

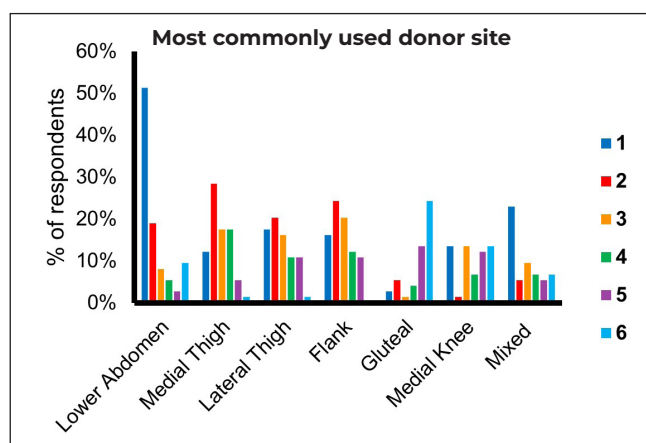


Fig 5. Most commonly used donor site for fat grafting, ranked 1 (most common) to 6 (least common) by each respondent

Autologous fat recipient and donor sites

Fat was grafted to all anatomical regions, with breast (86%) and face (73%) representing by far the most common recipient sites (Figure 4). Donor site selection was largely heterogeneous (Figure 5). There was a minor predilection for lower abdomen, with 51 per cent reporting it as their most used donor site. Lower abdomen (19%), lateral thigh (20%), flank (24%) and medial thigh (28%) were similarly ranked as most used secondary donor site. Twenty-four per cent ranked gluteal as their least used donor site.

Method of donor site selection

The method of donor site selection was more standardised. Ninety-six per cent used individual patient adipose distribution and 38 per cent used patient preference (Figure 6). Several other less common methods were recorded. Notably, only 11 per cent referred to literature.

Harvest technique

Seventy-four per cent reported use of manual aspiration while 60 per cent reported use of suction unit-assisted aspiration. These percentages indicate that many surgeons use both types of aspiration. The composition of the tumescent fluid used prior to harvest was also variable (Figure 7). The most common ingredients included adrenaline (84%), local anaesthetic (68%) and normal saline (61%). A number of other ingredients were used less frequently. Only 1 per cent (1 respondent) reported use of enzymatic digestion to isolate autologous stem cells.

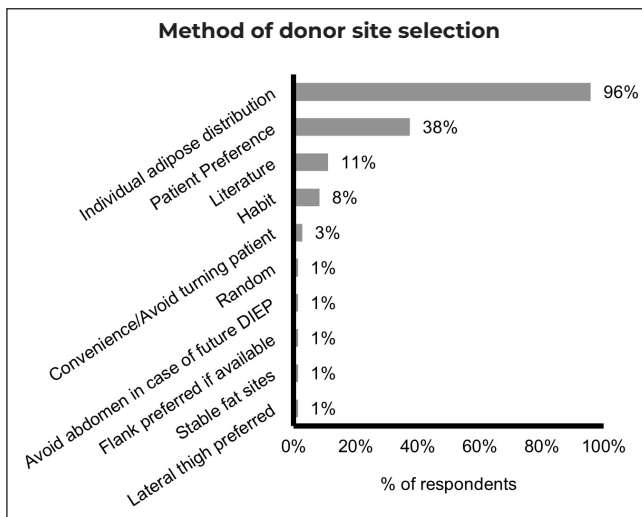


Fig 6. Methods of donor site selection for fat grafting and the percentage of respondents that used each method

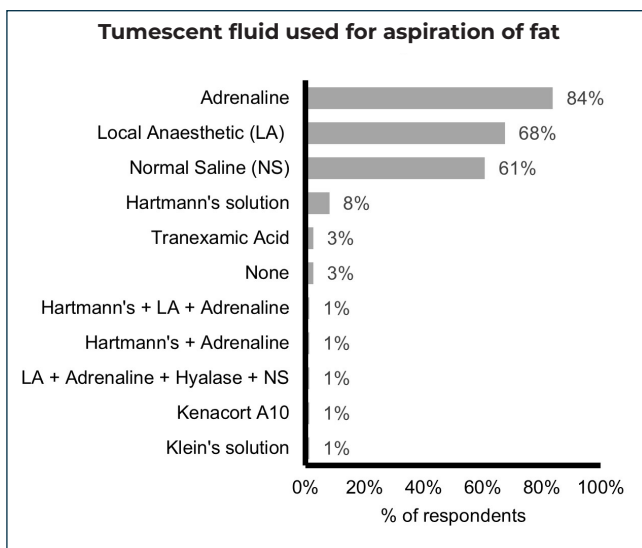


Fig 7. Types of tumescent fluid used for aspiration of fat for grafting and the percentage of respondents that used each type

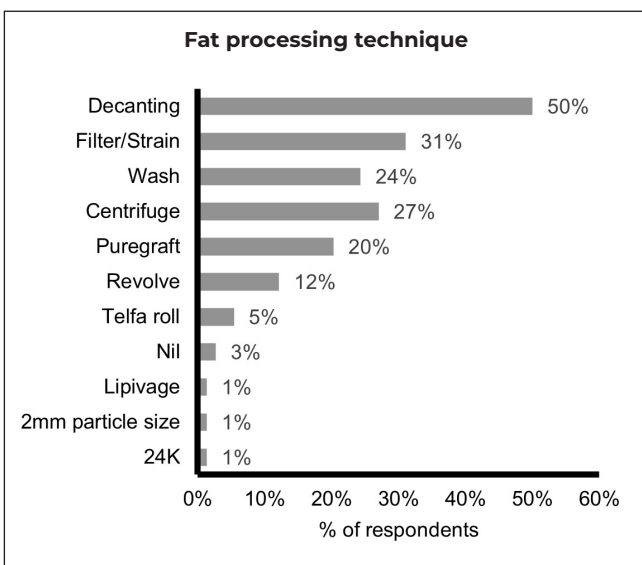


Fig 8. Techniques for processing of fat for grafting and the percentage of respondents that used each technique

AFG processing and postoperative course

The techniques used for fat processing were also highly variable. The most common processing techniques included decanting (50%), filtering or straining (31%), washing (24%), centrifugation (27%) and proprietary methods including Puregraft (Solana Beach, California 92075, USA) (20%) and Revolve (Allergan Australia Pty Ltd, North Sydney, New South Wales, 2060, Australia) (12%) (**Figure 8**). Seventy-five per cent recorded that more than one session of grafting was required to achieve the desired result (**Figure 9**). The need for multiple sessions may reflect variable graft survival,⁴⁻⁶ or intentional serial, smaller volume injection to optimise survival.⁷ The variability in number of graft sessions required may alternatively reflect that varying numbers of sessions are used for different indications. Eighty per cent of respondents did not use any post-grafting volumetric analysis (**Figure 10**). Methods that have been trialled include Vectra 3D imaging (Canfiled Scientific, Parsippany, New Jersey, 07054, USA) MRI, ultrasound, CUI (Mentor, Irvine, California,

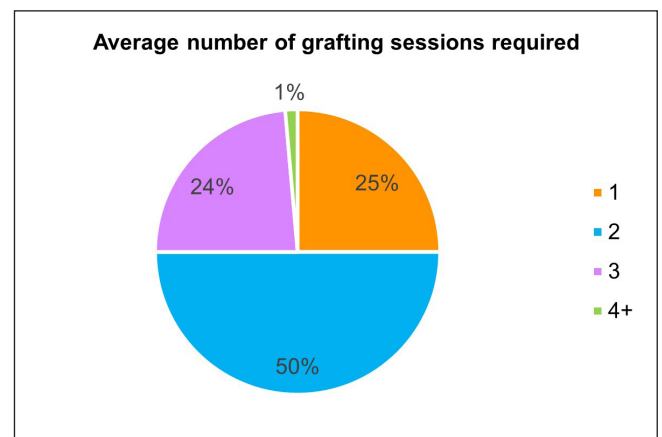


Fig 9. The average numbers of grafting sessions required to achieve desired filling by the percentage of respondents

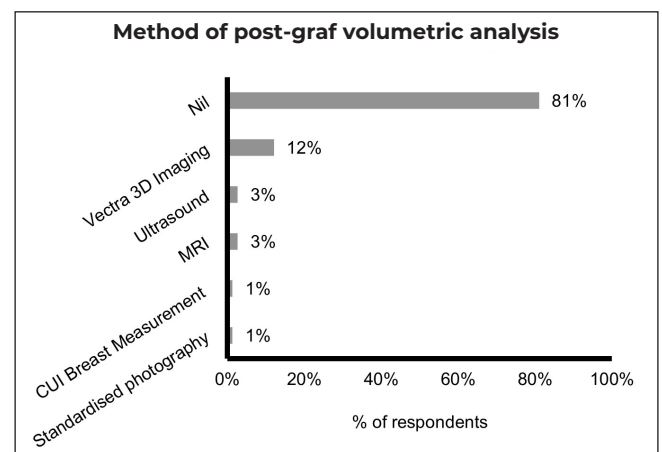


Fig 10. Methods of post-fat graft volumetric analysis and the percentage of respondents that used each method

USA) breast measurement device and standardised photography.

Discussion

Our results, which were compiled from a combination of a single question incorporated into the ABDR and a more comprehensive set of questions that comprised the first dedicated survey of fat grafting in Australian plastic surgery, demonstrated that the use of fat grafting is rapidly increasing in Australia. Nevertheless, clinical practice of fat grafting remains poorly standardised with respect to donor site selection, harvest technique, processing technique, number of sessions required and volumetric follow-up.

Heterogeneity in fat graft practice is consistent with findings from previous literature reviews we and others have completed.^{2,3} There is a lack of consensus regarding the most effective technique. This variability in technique likely contributes to the variable graft survival rates reported in the literature as 40–70 per cent.^{4–7} The nature of fat grafting consisting of multiple steps from fat harvest to fat injection likely further contributes to this variable graft survival.

To our knowledge, there are no retrospective or prospective human studies comparing fat graft survival with use of different tumescent fluid components, different donor sites or different harvest techniques. In terms of fat graft processing, a retrospective review of a single surgeon's experience of AFG with implant-based breast reconstruction in over 1000 patients comparing decantation to a proprietary closed wash and filtration method found a significantly higher rate of fat necrosis in the decantation group versus the Puregraft group (3.2% versus 1.0%, $p = 0.01$).⁸

The number of adipose derived stem cells (ASCs) in the graft also appears to contribute to fat graft survival. In 2013, Kolle and colleagues conducted a non-randomised placebo-controlled trial to investigate the effects of adding autologous, cultured ASCs to grafted fat and found a 65 per cent increase in volume retention by MRI volumetric assessment ($p < 0.0001$).⁹ The same group trialled this technique for large-volume lipotransfer in primary cosmetic breast augmentation and measured an 80.2 per cent mean retention rate in the ASC-enriched group compared to 45.1 per cent in the control group ($p = 0.0022$).¹⁰ Graft supplementation with platelet-rich plasma has shown a 30 per cent improvement in volumetric retention as measured by Gentile and colleagues,

who performed team-based clinical evaluations of breast contour post-lipotransfer.¹¹

The current process of gaining consent from patients for fat grafting is based on lower quality evidence from clinical case series, single-surgeon experiences and literature that reports highly variable outcomes based on the multitude of techniques used in the fat grafting process and for various indications. Altogether this suggests that more robust data from comparative clinical trials informing fat graft success rates and long-term retention would improve consent for patients undergoing autologous fat grafting as a primary reconstruction, augmentation or adjunct to other reconstructive options. Objective volumetric assessment devices, such as a protocolised ultrasound assessment, MRI or Vectra 3D imaging, will facilitate strong objective outcome measures of graft survival in future clinical trials.

Limitations

Our study had several limitations. The significant rise in recorded use of fat grafting since 2012 may reflect in part the increase in number of sites participating in the registry and increasing capture rates over time. Missing data is also a consideration, as fat grafting is reported through a tick box option. No tick is assumed to mean no fat grafting but may also reflect missing data, which would result in an underestimation of the prevalence of fat grafting use. The survey data was also limited by its 21 per cent response rate and subsequent 10 per cent margin of error. Victorian plastic surgeons represented 54 per cent of the survey data which was disproportionate to their 30 per cent representation of ASPS members. The survey results may therefore over-represent Victorian fat grafting practice. Finally, plastic surgeons are not the only surgeon group who perform fat grafting in Australia. General surgeons who perform fat grafting in breast surgery were not represented.

Notwithstanding this, the increasing use of this technique means that clinical data measuring the effect of patient demographics and procedural variables on fat grafting outcomes is vital to ensure patient safety, health resource management and to inform best practice guidelines. The information gathered by analysis of the heterogeneity in technique leading to specific outcomes will form a powerful foundation on which to base future regulatory decisions related to fat grafting and fat therapeutics.¹² Further, basic laboratory research is underway to characterise the cellular

heterogeneity within adipose tissue and between its depots, and may scientifically assist the decision-making processes to which clinicians and patients have access.¹³

As gene profiles and functional phenotypes of these heterogeneous cell populations are identified through our ongoing work, fat grafting and fat therapeutics may be further optimised. In addition to further basic science research, a registry database would provide the clinical data required to optimise and monitor this technique. A general registry of autologous fat transfer exists in the United States for American, Brazilian and Canadian plastic surgeons. As a historically significant contributor to clinical innovation and research in plastic surgery, it is important to characterise practice in our jurisdiction in order to ensure that both best practice is maintained and Australian plastic surgeons and researchers may optimally contribute to fat grafting practice globally.

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Patient consent

Patients/guardians have given informed consent to the publication of images and/or data.

Conflict of interest

The authors have no conflicts of interest to disclose.

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