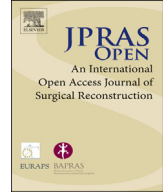




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## Original article

# Cell assisted lipotransfer in breast augmentation and reconstruction: A systematic review of safety, efficacy, use of patient reported outcomes and study quality

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## ABSTRACT

**Background:** Cell assisted lipotransfer serves as a novel technique for both breast reconstruction and breast augmentation. This systematic review assesses the efficacy, safety and use of patient reported outcome measures in studies involving cell assisted lipotransfer. We also carry out an objective assessment of study quality focussing on recruitment, follow-up and provide an up-to-date clinical trial landscaping analysis.

**Methods:** Key electronic databases were searched according to PRISMA guidelines and pre-defined inclusion and exclusion criteria. Two independent reviewers examined the retrieved publications and performed data extraction.

**Results:** 3980 publications were identified. Following screening, 11 studies were included for full review, representing a total of 336 patients with a follow-up time ranging from six to 42 months. A degree of variation was noted in graft retention and reported satisfaction levels, although there were only three comparative

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studies with conflicting results. Complications occurred at a rate of 37%. Additionally, there was a paucity of objective outcomes assessments (e.g. 3D assessment modalities or validated patient reported outcome measures) in the selected studies.

**Conclusions:** Cell assisted lipotransfer is a surgical technique that is currently employed sparingly within the plastic & reconstructive surgery community. Presently, further technical and outcome standardization is required, in addition to rigorous randomized controlled trials and supporting long-term follow-up data to better determine procedural safety and efficacy. Routine use of more objective outcome measures, particularly 3D assessments and validated patient reported outcome measures, will also help facilitate wider clinical adoption and establish procedural utility.

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## Introduction

Breast augmentation was the most commonly performed cosmetic procedure in the US in 2014 with over 102,000 procedures taking place.<sup>1</sup> Conventionally, implants have been utilized. However, their use is associated with a number of complications, notably capsular contraction, malposition, and anaplastic large cell lymphoma.<sup>2,3</sup> In a proportion of post-mastectomies, the use of implants is not possible due to the irregularity of the soft tissue defects, particularly in post-radiotherapy patients.<sup>4</sup> An alternative is the employment of complex reconstructive techniques including *deep inferior epigastric perforator* (DIEP) and *latissimus dorsi* (LD) flaps, that have an inherent complication risk and longer recovery periods.<sup>5</sup> Although cell assisted lipotransfer (CAL) will not replace these procedures (due to the shape and projection profiles they achieve), it has potential to serve as an adjunct for small corrections or volume increases, and may serve as a less invasive option for patients hoping to achieve subtle aesthetic enhancements. It should be noted that there is limited evidence to suggest that fat grafting without the use of adipose derived stem cell supplementation can be used for complete post-mastectomy reconstruction. This has, however, used a technique called BRAVA-assisted fat grafting where an external volume expansion device is applied to enhance graft survival. For example, Khouri 2015 conducted a level IV study on 488 women (616 breast) and concluded that BRAVA-assisted fat grafting is a minimally invasive, safe and economic alternative to other forms of breast reconstruction.<sup>6</sup> The technique has also been used by the same study author to investigate the effect of large volume fat grafting after BRAVA use or implant removal with positive results.<sup>7</sup> Adipose derived stem cells, fat grafting and external volume expansion technology is therefore a potential area of future research, specifically with regards to whole breast and large volume fat grafting.

An option for both breast augmentation and reconstruction is autologous fat grafting. Although studies have reported a more natural breast contour, reports of fat resorption have been reported.<sup>8</sup> Reported graft retention using this procedure vary from 40 to 75%, and therefore there is room for improvement in the efficacy of this procedure.<sup>9</sup> It has been found that the key to fat graft retention is maximizing the surface area to volume ratio, and the vascularity of the recipient area.<sup>10,11</sup> Studies have suggested that adipose derived stem cells can survive the period of hypoxia post surgery that is thought to result in the necrosis of conventional fat.<sup>11</sup> This provides scientific rationale to using CAL in breast surgery and is why the use of this technique can be seen as a key development in the repertoire of techniques available to surgeons.<sup>12</sup>

CAL utilizes fat grafts that have been enriched with a patient's adipose derived stem cells (Figure 1 compares CAL to autologous fat transfer). Adipose derived stem cells are able to enhance both angiogenesis and adipogenesis. Translating this into the clinical setting, it is hoped that long-term graft retention and lower post-operative complication rates will result.<sup>13,14</sup> The abundance of adipose tissue

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