

# Fat Grafting for Burn, Traumatic, and Surgical Scars

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## KEYWORDS

• Fat grafting • Burn reconstruction • Scar management

## KEY POINTS

- An increasing volume of literature supports fat grafting for the treatment of problematic scars.
- Transferred adipose tissue provides a mechanical effect and a putative regenerative environment that improves scar qualities and scar related symptoms.
- Fat grafting may improve symptoms in patients with refractory neuropathic pain in burn scars.
- With the expanding role of autologous fat grafts, regulatory issues surrounding its use must be considered continuously.

## INTRODUCTION

Free autologous fat transfer was first described in 1893 when Franz Neuber reported the harvest of fat from a patient's arm to fill a defect in the cheek cause by tuberculosis of the maxilla.<sup>1</sup> Eugene Hollander was the first to report the use a needle and syringe to transfer fat into the face of a patient with lipoatrophy in 1912.<sup>2</sup> Over the remainder of the 20th century, multiple reports emerged on the use of fat grafting as a soft tissue filler; however, these uses were associated with substantial variability in results. It was not until Sydney Coleman described a strict protocol for harvesting and injecting fat that results became more reliable. As a result, the popularity of fat grafting surged and its clinical applications diversified.<sup>3</sup>

In 2007, Rigotti and colleagues<sup>4</sup> described the use of autologous fat grafts to treat radiation-induced skin lesions, and showed that autologous fat grafts have the ability to improve local tissue environment in humans. They proposed that regeneration

occurred owing to adipose-derived stem cells within the lipoaspirate. The usefulness of fat grafting continued to expand, and lipotransfer became recognized as a versatile medium possessing valuable mechanical and regenerative properties.

Reports began to emerge investigating the role of fat grafting for treating various types of scars, with promising results. In 2008, Klinger and colleagues<sup>5</sup> published a case series of 3 patients with burns to the face who underwent fat grafting and had improvement in scar quality. Additional reports described fat grafting to various traumatic, surgical, and burn scars with improvement in scar qualities.<sup>5-7</sup>

Many investigators noted that scar-related pain improved after fat grafting, which has led to recent interest in the use of fat grafting to treat painful scars. Fat grafting has been shown to improve symptoms in patients with painful surgical scars, traumatic scars, and postmastectomy pain syndrome.<sup>8-14</sup> In 2016, we investigated the possible role of lipotransfer in treating neuropathic pain in burn scars and showed that adipose tissue can

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be safely grafted into burn scars and may improve symptoms in patients with refractory neuropathic pain after burn injury.<sup>8</sup> A prospective study is currently underway to quantify the improvement in pain and quality of life that is observed after fat grafting in patients with chronic neuropathic burn scar pain.

In this article, we review the current literature on fat grafting for scars, discuss the physiology of fat grafting as it relates to management of problematic scars, present our approach for the use of fat grafting to manage painful burn scars, and elaborate on current regulatory issues surrounding autologous fat grafting.

## LITERATURE REVIEW

Over the past decade, there has been an abundance of literature published about fat grafting (Fig. 1). Recognition of the beneficial effects of transferred fat on local tissue has generated interest in fat grafting for problematic scars. Recent systematic literature reviews by Negenborn and colleagues and Condé-Green and colleagues<sup>15,16</sup> provide a detailed analysis of studies reporting the use of fat grafting for scars, including burn scars, and scar-related conditions. **Table 1** provides an updated summary of the literature on fat grafting for scars and scar-related conditions. Case reports, as well as studies that use autologous fat mixed with platelet-rich plasma, enhanced with stromal vascular fraction or similarly manipulated are not included in this review.

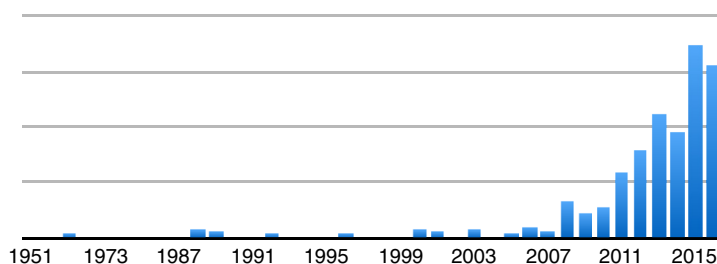
Most studies are small prospective or retrospective cohort studies, or case series, representing level III or IV evidence according to the 2011 Center for Evidence-Based Medicine guidelines.<sup>30</sup> Although all studies reviewed show some level of improvement in scar qualities or scar-related symptoms after fat grafting, the majority of research reflects low-level evidence. Level I data, in the form of randomized, blinded, placebo-controlled studies, are needed. One such study is currently underway by Katz and colleagues,<sup>31</sup>

and its results will provide an essential contribution to the fat grafting literature.

Two case-control studies have been performed with “split scar” studies, injecting one-half of the scar with fat, and the other half with saline.<sup>19,21</sup> In 2013, Bruno and colleagues<sup>19</sup> performed a split scar study on 93 patients with burn scars, noting improved scar qualities in the areas that were fat grafted. In 2013, Klinger and colleagues<sup>21</sup> published the largest series of patients with problematic scars, who underwent autologous fat grafting. There were 694 patients treated, 376 of whom had scars from burn injuries. Clinical assessment showed an improvement in scar quality in all patients, in particular relief from pain and an increase in scar elasticity was noted. In 20 patients from this cohort, a split scar assessment was performed, and outcomes assessed using the Patient and Observer Scar Assessment Scale questionnaire and Durometer measurements. Fat grafted areas had a significant decrease in hardness and improvement in all scar qualities except itching.

There have been 2 randomized, controlled trials investigating the role of fat grafting in the treatment of postmastectomy pain syndrome, for which postoperative scarring is thought to be the major contributor.<sup>9,13</sup> In 2011, Caviggioli and colleagues<sup>9</sup> presented their results of fat grafting 72 patients with postmastectomy pain syndrome, compared with 41 controls, and showed a significant reduction in pain after fat grafting. In 2016, Juhl and colleagues<sup>13</sup> showed similar results after comparing 8 patients with postmastectomy pain syndrome who underwent fat grafting to 7 controls. In these patients, significant short- and long-term symptom improvement was reported.

The exact mechanism by which fat grafting may improve scarring continues to be elucidated. Scars caused by trauma or burns are often deficient in volume, especially subcutaneous adipose tissue, which may be lost in severe burns. Adipose tissue has long been considered an ideal filler and restores missing volume to fill depressions, restore contour, and provide increased cushioning, which aside from aesthetic improvements, has a



**Fig. 1.** Published articles on “Fat Grafting” over time (Based on Pubmed search for “Fat Grafting”).

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