OPEN

ORIGINAL ARTICLE
Cosmetic

Fat Grafting: A Citation Analysis of the Seminal Articles

Cormac W. Joyce MB, BCh*
Kenneth M. Joyce MB, BCh*
George Rahmani MB, BCh*
Stewart R. Walsh, MD†
Sean M. Carroll, MD‡
Alan J. Hussey, MD*
Jack L. Kelly, MD*

Background: There has been substantial rise in the volume of published works on fat transfer in the medical literature in the past 25 years, and this is indicative of its growing popularity. However, many unanswered questions remain, and there is no consensus as to the optimum technique. Consequently, the scientific and clinical research on fat grafting continues to increase rapidly. The purpose of our study was to perform a bibliometric analysis of the most-cited articles in fat transfer.
Methods: Through the Web of Science, all articles relating to fat grafting were identified in the plastic and reconstructive literature. The 100 most-cited articles were identified and analyzed individually.
Results: Total citations ranged from 35 to 363 and the most-cited paper by Sidney Coleman was published in *Plastic and Reconstructive Surgery*. The United States produced 46% of the most-cited papers, and the University of California was the most prolific institution. Twenty-one articles focused on lipofilling to the face while 14 articles looked at fat grafting to the breast.
Conclusions: The scientific relevance of a published work is reflected in the number of citations from peers that it receives. Therefore, the 100 most-cited papers in fat grafting have been the most influential articles on this field, and they are likely to be the ones that are remembered most. *(Plast Reconstr Surg Glob Open 2015;3:e295; doi: 10.1097/GOX.0000000000000269; Published online 27 January 2015.)*

In 1893, the first description of free fat transfer was reported by Neuber,[1,2] where he filled soft-tissue contour defects with small amounts of fat. Despite a successful outcome, fat grafting as a procedure has remained relatively dormant until recent years. Nowadays, it is one of the most commonly performed procedures carried out by plastic surgeons worldwide. This renaissance in fat grafting is reflected in the medical literature, with a rapidly growing subsection devoted to autologous fat transplantation.

Fat grafting, however, remains a contentious issue within plastic surgery with no consensus as to how to optimally perform the procedure. Various methods of harvesting and transfer have been described, and the published results vary considerably. Despite a rapidly growing volume of articles pertaining to fat grafting in the medical literature, it remains unclear as to which articles have been the most influential on this field.

A citation is an abbreviated alphanumeric expression that supports the relevance given by the author to the work of others on a subject of discussion in which the citation appears. The citation number of a published piece of work is the most recognized method of assessing its relative importance to a specific area.[3] Although it is the most-used mode of gauging the influence of a body of work, it is an inherently

*From the *Department of Plastic Surgery, University Hospital Galway, Galway, Ireland; †Department of Vascular Surgery, University Hospital Galway, Galway, Ireland; and ‡Department of Plastic Surgery, Saint Vincent's University Hospital, Dublin, Ireland.*
Received for publication September 5, 2014; accepted November 24, 2014.

DOI: 10.1097/GOX.0000000000000269

Disclosure: *The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by the authors.*

flawed system. The role of the citation is to recognize other authors for their influential and pertinent articles that they have previously published. The relative impact of a published body of work is reflected in the actual number of citations from peers that it receives, so that its scientific relevance increases with an increasing citation count.

In an era where "publish or perish" is increasingly apparent, the number of citations is being used to determine how grants and subsidies are awarded.[3–5] The number of citations is of critical importance to the journal also, as the more citations that a particular article receives, the greater the impact factor (IF) of the journal.[6] The IF was devised to facilitate comparisons between journals within specific fields of academic interest.[7] It is a measure that is indicative of the average number of citations of recent articles published by the journal.[6,8,9] The higher the IF, the more influential and noteworthy the journal is apparently deemed. Notwithstanding the obvious flaws associated with the IF system,[4] it is still widely regarded as the best available mode of gauging the merits of specific publications.[3] For a given year, the IF can be calculated by averaging the number citations received per article published in that journal during the preceding 2 years.[7]

A citation analysis is a bibliometric method that describes the means of analyzing the citation history of published articles.[10] The purpose of this study was to identify the 100 most-cited articles relating to fat grafting in the medical literature and to carefully analyze each article individually looking at the article type, year of publication, authorship, country of origin, institution, and level of evidence.

MATERIALS AND METHODS

Eighteen international journals were included in our citation analysis, and these were selected based on an overall consensus reached by 2 of the authors. The publications included 10 well-known plastic and reconstructive journals and 8 high IF surgical journals (Table 1). The 8 surgical journals were included as there was agreement by the authors that these would be the most likely to publish articles pertaining to fat grafting.

Table 1. The Journals and the Number of Articles Each Journal Contributed to the Top 100 Most-cited Articles on Fat Grafting

Journal	No. Articles in Top 100
Plastic and Reconstructive Surgery	51
Aesthetic Plastic Surgery	23
Clinics in Plastic Surgery	10
Annals of Plastic Surgery	12
Journal of Plastic, Reconstructive and Aesthetic Surgery	3
American Journal of Surgery	1

The Annals of Surgery, British Journal of Surgery, Surgery, American Journal of Surgery, Aesthetic Surgery Journal, Archives of Facial Plastic Surgery, British Journal of Plastic Surgery, Canadian Journal of Plastic Surgery, European Journal of Plastic Surgery, Journal of the American College of Surgeons, Journal of Plastic Surgery and Hand Surgery, and *Scandinavian Journal of Plastic Surgery and Reconstructive Surgery* were included in the search, but they did not contribute to the top 100.

The Institute of Scientific Information produces the Web of Science (Thomson Reuters, NY, N.Y.), and this facilitates access to the Science Citation Index,[11] MEDLINE, and other citation indices, which collectively index more than 12,000 journals. Using this electronic database, we were able to identify the most-cited articles on fat grafting from 1945 to 2014 in our chosen journals.

All Web of Science (Thomson Reuters) indexed articles from the 18 journals were combined in our search and the resulting articles (144,246 in total) were then ranked in order of times cited. To locate articles relating to fat grafting, specific keywords were added separately into the Web of Science (Thomson Reuters) database and the chosen 18 journals were searched. The keywords used were "fat," "fat transplant," "fat graft," "lipotransfer," "lipoaspirate," "adipocyte," and "adipose stem cells." The filtered results were examined by 2 of the authors independently looking for articles on fat grafting. An article was only selected for further analysis if both authors agreed it was suitable. The 100 most-cited articles on fat grafting were then chosen for further analysis. Each individual article was analyzed looking at its subject matter, authorship, article type, country of origin, institution, year of publication, and level of evidence.

RESULTS

The top 100 articles on fat grafting are in descending order based on citation number in Table 2. Citation numbers ranged from 35 to 363, with a mean of 83 ± 60.7. Eighteen international journals were initially included for analysis in our study but only 6 journals contributed articles to the 100 most-cited list (Table 1). These included 5 specialist plastic and reconstructive journals: *Plastic and Reconstructive Surgery* (*PRS*), *Aesthetic Plastic Surgery*, *Clinics in Plastic Surgery*, *Annals of Plastic Surgery*, and *Journal of Plastic, Reconstructive and Aesthetic Surgery*. The only general surgery journal that contributed to the top 100 was the *American Journal of Surgery*. Fifty-one percent of articles originated from *PRS* while *Aesthetic Plastic Surgery* produced 23 articles. The *Annals of Plastic Surgery* produced 12 articles while *Clinics in Plastic Surgery* had 10 articles in the top 100.

The article with the highest citation number was written by Coleman,[12] and it has been cited 363 times

Table 2. The List of 100 Most-cited Articles on Fat Grafting

Rank	Author	Citations	Rank	Author	Citations	Rank	Author	Citations
1	Coleman[12]	363	34	Lu et al[13]	79	67	Chan et al[14]	50
2	Coleman[15]	258	35	Dragoo et al[16]	77	68	Toledo[17]	50
3	Billings and May[2]	257	36	Guerrerosantos et al[18]	75	69	Torio-Padron et al[19]	49
4	Ersek[20]	225	37	Dudas et al[21]	75	70	Har-Shai et al[22]	49
5	Mizuno et al[23]	215	38	Gutowski[24]	74	71	Zheng et al[25]	46
6	Coleman[26]	215	39	Kaufman et al[27]	71	72	Coleman[28]	45
7	Yoshimura et al[29]	211	40	von Heimburg et al[30]	70	73	Pereira and Radwanski[31]	45
8	Coleman[32]	209	41	Moore et al[33]	69	74	Pu et al[34]	44
9	Ashjian et al[35]	197	42	Teimourian[36]	69	75	Feinendegen et al[37]	44
10	Peer[38]	189	43	De Ugarte et al[39]	68	76	Wolter et al[40]	43
11	Coleman and Saboeiro[41]	186	44	Carraway and Mellow[42]	68	77	Schoeller et al[43]	43
12	Niechajev and Sevcuk[44]	184	45	Pu et al[45]	68	78	Guerrerosantos[46]	41
13	Chajchir and Benzaquen[47]	150	46	Chajchir and Benzaquen[48]	67	79	Mojallal et al[49]	41
14	Ellenbogen[50]	136	47	Fagrell et al[51]	63	80	Gonda et al[52]	41
15	Illouz[53]	129	48	Moscona et al[54]	63	81	Hudson et al[55]	41
16	Katz et al[56]	127	49	Bircoll and Novack[57]	63	82	Serra-Renom et al[58]	40
17	Moseley et al[59]	113	50	Kurita et al[60]	63	83	Serra-Renom and Fontdevila[61]	40
18	Smith et al[62]	110	51	Stosich and Mao[63]	59	84	Khouri and Del Vecchio[64]	39
19	Rohrich et al[65]	109	52	Carpaneda and Ribeiro[66]	59	85	Rigotti et al[67]	39
20	Kononas et al[68]	107	53	Eppley et al[69]	59	86	Lu et al[70]	39
21	Coleman[71]	102	54	Ramon et al[72]	58	87	Gonzalez et al[73]	39
22	Bircoll[74]	101	55	Klinger et al[75]	58	88	Cárdenas-Camarena et al[76]	37
23	Hörl et al[77]	100	56	Guerrerosantos[78]	58	89	Baran et al[79]	38
24	Lee et al[80]	99	57	Tholpady et al[81]	58	90	Hyakusoku et al[82]	37
25	Spear et al[83]	90	58	Carpaneda and Ribeiro[84]	57	91	Marra et al[85]	36
26	Schipper et al[86]	90	59	Chajchir[87]	56	92	Trepsat[88]	36
27	Yuksel et al[89]	87	60	Ersek et al[90]	55	93	Castello et al[91]	36
28	Loeb[92]	86	61	Guerrerosantos[93]	54	94	Lewis[94]	36
29	Kaufman et al[95]	82	62	Chajchir et al[96]	54	95	Pinsolle et al[97]	35
30	Boschert et al[98]	81	63	Zhu et al[99]	53	96	Loeb[100]	35
31	Illouz[101]	80	64	Ullmann et al[102]	53	97	Zocchi and Zuliani[103]	35
32	Matsudo and Toledo[104]	80	65	Kesselring[105]	53	98	Toledo and Mauad[106]	35
33	Peer[107]	79	66	Illouz and Sterodimas[108]	52	99	Vaienti et al[109]	35
						100	Locke and de Chalain[110]	35

Table 3. The Decades That Contributed to the Top 100 Most-cited Articles on Fat Grafting

Decade	No. Articles
2000s	53
1990s	29
1980s	13
2010–2014	3
1950s	2

Table 4. The Anatomical Sites for Fat Grafting in the Top 100 Articles

Fat Graft Location	No. Articles
Face	21
Trunk	14
Breast	20
Hands	1

Table 5. The Levels of Evidence of the 100 Most-cited Articles on Fat Grafting

Clinical Study Type	No. Studies
Therapeutic	55
Level 2	4
Level 3	10
Level 4	19
Level 5	22
Prognostic	6
Level 4	2
Level 5	4

to date. This article, published in *Clinics in Plastic Surgery* in 1997, was a landmark article insofar that it was one of the first modern-day descriptions of lipofilling to the face using the Coleman method of fat transfer.[45] The oldest article in the top 100 was from 1950 and written by Peer.[38] It is the 10th most-cited article (189 citations) and was published in *PRS*. This early article on fat transfer, in which Peer postulates on the "cell survival theory," describes the mixed results he encountered when a group of individuals were fat grafted. The most recent article in the top 100 was written by Rigotti et al[67] and published in August 2010 in *Aesthetic Plastic Surgery*. This article examined the perceived oncological risk in fat transfer to the breast for postmastectomy patients. The decade that contributed the most articles to the top 100 articles on fat grafting was the 2000s with 53 articles (Table 3). Eighty-five percent of the top articles were published since 1990, thereby highlighting the recent surge in fat grafting procedures.

To facilitate the analysis of the characteristics of each article, the 100 articles were placed into 4 different categories based on the anatomical location of the fat grafting (Table 4). Twenty-one articles focused on lipotransfer to the face while 20 articles looked at fat grafting to the breast. Four-

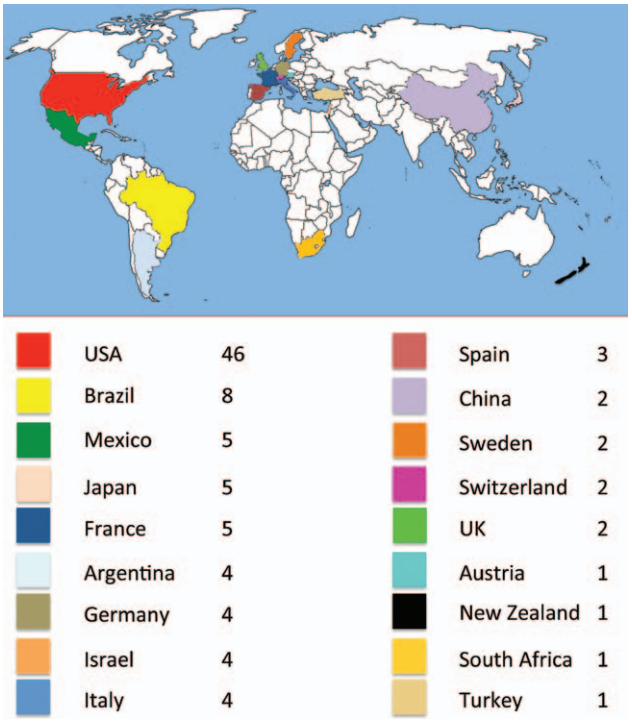

Fig. 1. Top 100 most-cited articles in fat grafting.

Table 6. The Institutions That Contributed Most Articles to the Top 100 List

Rank	Institution	No. Articles
1	University of California System, Calif.	8
2	New York University, School of Medicine, N.Y.	7
3	University Guadalajara, Mexico	4
4	University of Pittsburgh, Pa.	4
	Technion, Israel Institute of Technology, Israel	4
	Zubizarreta Hospital, Buenos Aires, Argentina	4
5	University of Texas System, Tex.	3

teen articles described fat transfer to contour defects of the trunk, and one solitary article looked at fat grafting to the hands. Sixty-five articles in the top 100 were clinical, and the remainder was laboratory-based including animal studies. Seven articles were review articles, whereas 2 articles were published correspondence to the editor of that particular journal.[36,53] One of the letters to the editor reported on a rare case of blindness following fat grafting to the face,[36] whereas the other letter by Illouz[53] reports on his early experience of lipotransfer from 1983. The majority of the studies in the top 100 were level IV or V evidence (77%) while there was no level I studies (Table 5).

The top 100 most-cited articles in fat grafting originated from 18 countries, with the United States contributing the most with 46 articles (Fig. 1). Brazil produced 8 articles while Mexico, Japan, and France

Table 7. The Authors Who Contributed Most Articles to the Top 100 List

Author	No. Citation Classics	Position on Author List
Coleman	8	First author—7, second author—1
Hedrick	7	Third author—2, fourth—1, sixth—1, seventh—2, ninth—1
Guerrerosantos	5	First author—4
Chajchir	4	First author—4
Rubin	4	Fourth author—1, fifth—1, seventh—1, eighth—1
Zhu	4	Second author—1, third—1, fifth—1
Benhaim	3	Fifth author—1, eighth—2
Benzaquen	3	Second author—3
De Ugarte	3	First author—1, fourth—1
Illouz	3	First author—3
Marra	3	Second author—2
Ogawa	3	Second author—1, fourth—1, fifth—1
Pu	3	First author—2, eighth—1
Sato	3	Second author—1, fourth—1
Toledo	3	First author—2, second—1
Ullman	3	First author—1, second—1, eighth—1
Zuk	3	Second author—1, sixth—2
Ashjian	2	First author—1, second—1
Beach	2	Fourth author—1
Bircoll	2	First author—2
Bradley	2	Second author—1, seventh—1
Brown	2	Third author—1, seventh—1
Carpaneda	2	First author—2
Elbarbary	2	Second author—1, third—1
Ersek	2	First author—2
Futrell	2	Fourth author—1, fifth—1
Gonda	2	First author—1, fifth—1
Har-Shai	2	First author—1, third—1
Hirshowitz	2	Fourth author—1, fifth—1
Hyakusoku	2	First author—1, sixth—1
Katz	2	First author—1, sixth—1
Kaufman	2	First author—2
Kurita	2	First author—1, fourth—1
Lindenbaum	2	Second author—1, sixth—1
Llull	2	Second author—2
Matsumoto	2	Second author—1, fourth—1
Miller	2	Second author—1, tenth—1
Mizuno	2	First author—1, second—1
Peer	2	First author—2
Schipper	2	First author—1, sixth—1
Serra-Renom	2	First author—2
Ribeiro	2	Second author—2
Rohrich	2	First author—1, sixth—1
Shigeura	2	Second author—1, third—1
Sorokin	2	Second author—1, fifth—1
von Heimburg	2	First author—1, second—1
Wasson	2	Fifth author—2
Yoshimura	2	First author—1, twelfth—1

published 5 articles each. The institution that produced the most articles was the University of California system with 8 articles (Table 6), whereas the New York University School of Medicine published 7 articles. Eleven authors were first-named authors on more than 1 article (Table 7), whereas 48 authors contributed to more than 1 article overall. The most illustrious author was Coleman as he was first-named author on 7 articles while Guerrerosantos and Chajchir were first-named authors on 4 articles each.

The second most-cited article in the top 100 was another article by Coleman, and this has been cited 258 times to date. This article retrospectively examined over 400 fat injections to the face and compared it to a control. This article was the first article detailing the Coleman technique for fat transplantation. The third article on the most-cited list was a review on fat grafting written by Billings and May[2] and published in *PRS*. This 1989 article revisited the topic of fat grafting as it had been a seemingly neglected topic for many years in plastic surgery, most likely due to unpredictable results coupled with an absence of a clear understanding of how it worked.

At number 7 in the top 100 list, Yoshimura et al[29] described a novel technique for breast augmentation using lipofilling in conjunction with cell-assisted transfer. They found that postoperative fat atrophy was negligible compared to fat grafting alone. The 14th most-cited article was published in the *Annals of Plastic Surgery* in 1986. This article by Ellenbogen[50] was a preliminary report on the use of fat as a facial filler, and it has been cited 136 times to date.

At 19, Rohrich et al[65] examined the role of centrifugation along with harvest site in fat grafting. As fat grafting yields such unpredictable results with varying amounts of fat resorption, there have been numerous attempts at refining the technique. Proposed measures to improve fat survival include centrifugation and fat harvest from certain anatomical sites. Rohrich et al[65] found that centrifugation had no effect on fat viability, and neither was there any difference in adipocyte viability between several donor sites.

Results from the "Autologous fat transfer national consensus survey"[95] were at 29. This article published the results of a survey of 508 plastic surgeons. The aim of the survey was to assess their technique used in fat grafting and ascertain their level of success with their chosen method. Overall, most surgeons did not deviate from published methods of fat grafting, and 80% of them were happy with the long-term results.

The American Society of Plastic Surgeons Fat Graft Task Force was set up in 2007 to conduct an assessment regarding the efficacy and safety of autologous fat grafting.[111] The recommendations put forward by this task force were at number 38 in the most-cited list. This article detailed the evidence-based practice recommendations put forward by the task force on fat transfer. At number 55, Klinger et al[75] reported on their experience with fat grafting of burn wounds. Using the Coleman fat transfer method, scars from burns were injected and reviewed at

6 months whereby histological examination demonstrated changes suggestive of tissue regeneration.

At 90th position in the top 100, Hyakusoku et al[82] reported on the complications associated with autologous fat injection to the breast, including calcifications and cysts. Furthermore, they also observed that routine breast cancer screening would detect abnormalities following fat grafting.

DISCUSSION

Fat transfer is now an invaluable tool in the plastic surgeon's armamentarium, and its growth in popularity is echoed in the large volume of published material. The purpose of our study was to identify the 100 most-cited articles in fat grafting and to further analyze each article individually. As the citation count of an article is a reflection of its influence on a particular field, the most-cited articles in fat transfer are the published works that have made the biggest impact on our specialty. The top 100 list contains articles that represent most of the key moments in the evolution of fat grafting written by illustrious authors who are well-renowned experts in the art of fat transfer.

Despite the fact that most of the key articles on fat grafting are present on our top 100 list, several landmark articles have failed to be included in the top 100. This may be explained by the phenomenon of "obliteration by incorporation," whereby "classic articles" fail to be cited over time as they have become such common knowledge. A prime example of this is the 2012 article by Khouri et al[112], which reports on the dual use of lipotransfer and the Brava (Brava, LLC, Miami, Fla.) device for breast augmentation. Despite being a well-known article with over 30 citations, it failed to make it in to the top 100.

A study of this nature is not without limitations, however. Several biases exist with bibliometric analyses, including self-citation, journal bias, in-house bias, and omission bias, whereby academic competitors are purposely not cited. Incomplete citing is a considerable limitation that occurs when citations are made to persuade the reader rather than recognizing key works in that particular area.[8]

It is argued that the most influential articles that have made the most impact on a specific specialty can be found on the reference list of their most-cited articles.[113] It has also been proposed that older articles have a higher citation count than more recent articles based on a longer citable period.[4] Scientific articles tend not to be cited frequently until 2 years after publication and usually reach a maximum after 3–10 years after which they continue to be cited, albeit at a slower rate.[114] Consequently, several methods have been devised to remedy this perceived bias. The citation index, as described by Loonen et al,[7] was defined as the average number of times an article has been cited per year up to 16 years after publication. Sixteen years was accepted as the critical citable period as they found that the most significant change in annual increase of the fraction of citations occurred at this time point. For articles that had been published within the last 16 years, the total citation number since publication was divided by the number of years since publication. However, we have found that the citation index heavily favors more recently published articles[115] and several reasons account for this. The growing utilization of electronic citation managers (ie, EndNote, Thomson Reuters) facilitates rapid incorporation of references into modern-day articles, which would not have been as readily achievable in previous years. Also, most recent published works tend to be available online and are therefore much more accessible than older articles that often require significant effort to locate.

Eighty-five percent of the top 100 articles were published in the past 24 years, and this highlights how fat grafting has soared in popularity in recent times. It is important to recognize the contribution Peer[38] made to fat transfer as his seminal work was published in the 1950s in an era when fat grafting was not commonplace. It is a testament to his work that 2 of his articles are in the top 100.

There is a paucity of studies in plastic surgery with high levels of evidence.[116,117] The majority of the clinical studies in the top 100 most-cited list were level IV or V evidence, which is in keeping with what Loonen et al[7] found when they analyzed the characteristics of the top 50 articles in plastic surgery. In contrast to medicine, surgery by its very nature does not lend itself to randomized control trials, as it is difficult to standardize surgical procedures. Furthermore, a limited disease incidence coupled with the variation in experience and expertise between surgeons renders surgical procedures less suitable for level I studies. The intended outcome in fat grafting is for an aesthetically pleasing result with added volume. Therefore, the level IV and V studies published on fat grafting are as important to this field as the higher level of evidence studies are to other disciplines.

The top 100 list contains articles that document the entire history of fat grafting. Bircoll[57,74] and Coleman[12,15,26,28,32,41,45,71] are widely attributed with pioneering the procedure in the 1990s, and as such, both authors are well represented in the top 100 list. Although several articles predate the work of Bircoll[57,74] and Coleman,[12,15,26,28,32,41,45,71] they are largely responsible for the surge in popularity of fat grafting. The Coleman technique for fat grafting is one of the most commonly employed techniques for fat transplantation, yet numerous other techniques have been published. The results of the varied different techniques

for fat grafting are quite similar, thus indicating that no one technique is superior. The Coleman technique of low-volume lipofilling is in stark contrast to the mega-volume fat transfer described by Khouri et al.[118]

Despite having a better understanding of fat grafting today than we did in the 1950s, there still remain many unanswered questions.[119] No consensus has been reached on the optimum technique for any of the 3 steps in fat transfer: harvesting, processing, and lipofilling.[119] This is highlighted by the fact that there are so many laboratory-based animal studies in the top 100 list which seek to find the answer to optimizing adipocyte viability. Refinements in the technique of fat grafting have yielded improved results, yet there remains a huge discrepancy in outcomes between patients. Despite this, it is a rapidly evolving field within plastic surgery, and it has transformed clinical practice in recent years. Although it was first described more than 120 years ago, fat transfer still remains in its infancy due to its neglect for so many years. The number of indications for fat grafting continually grows as it becomes used in a plethora of conditions.[120–122] This is evident in the expanding medical literature that continuously reports on newly unearthed benefits of fat grafting,[123] which, in turn, further drives scientific research.

CONCLUSIONS

The top 100 list generated from our analysis not only identifies the landmark papers that have had the most influence on fat grafting but also acknowledges the most prolific authors and institutions that have contributed papers to the list. Many articles described pioneering methods and techniques that are still used today. Citation analysis is certainly not a measure of scientific quality and certain intrinsic limitations exist with it. However, it does provide an objective and quantitative measure of the impact that an article has on its respective field. More importantly, it provides useful information on readership. The top 100 papers on fat grafting were all written by experts in the field and their importance is reflected in the large number of citations they received from their peers.

Cormac W. Joyce, MB, BCh, BAO
27 Rowanbyrn, Blackrock
County Dublin, Ireland
E-mail: cormacwjoyce@gmail.com

REFERENCES

1. Neuber G. Asepsis und kunstliche Blutleere. *Verhandl d deutsch Gesellsch F Chir (Berl).* 1910;22:159.
2. Billings E Jr, May JW Jr. Historical review and present status of free fat graft autotransplantation in plastic and reconstructive surgery. *Plast Reconstr Surg.* 1989;83:368–381.
3. Seglen PO. Why the impact factor of journals should not be used for evaluating research. *BMJ* 1997;314:498–502.
4. Loonen MP, Hage JJ, Kon M. Value of citation numbers and impact factors for analysis of plastic surgery research. *Plast Reconstr Surg.* 2007;120:2082–2091.
5. Paladugu R, Schein M, Gardezi S, et al. One hundred citation classics in general surgical journals. *World J Surg.* 2002;26:1099–1105.
6. Garfield E. [The impact factor and its rightful use]. *Anaesthesist* 1998;47:439–440.
7. Loonen MP, Hage JJ, Kon M. Plastic surgery classics: characteristics of 50 top-cited articles in four plastic surgery journals since 1946. *Plast Reconstr Surg.* 2008;121:320–327.
8. Garfield E. Journal impact factor: a brief review. *CMAJ* 1999;161:979–980.
9. Garfield E. 100 citation classics from the Journal of the American Medical Association. *JAMA* 1987;257:52–59.
10. Kelly JC, Glynn RW, O'Briain DE, et al. The 100 classic papers of orthopaedic surgery: a bibliometric analysis. *J Bone Joint Surg Br.* 2010;92:1338–1343.
11. Institute for Scientific Information. Journal Citation Reports. Available at: www.wofinfo.com Accessed August 31, 2014.
12. Coleman SR. Facial recontouring with lipostructure. *Clin Plast Surg.* 1997;24:347–367.
13. Lu F, Mizuno H, Uysal CA, et al. Improved viability of random pattern skin flaps through the use of adipose-derived stem cells. *Plast Reconstr Surg.* 2008;121:50–58.
14. Chan CW, McCulley SJ, Macmillan RD. Autologous fat transfer—a review of the literature with a focus on breast cancer surgery. *J Plast Reconstr Aesthet Surg.* 2008;61:1438–1448.
15. Coleman SR. Long-term survival of fat transplants: controlled demonstrations. *Aesthetic Plast Surg.* 1995;19:421–425.
16. Dragoo JL, Lieberman JR, Lee RS, et al. Tissue-engineered bone from BMP-2-transduced stem cells derived from human fat. *Plast Reconstr Surg.* 2005;115:1665–1673.
17. Toledo LS. Syringe liposculpture: a two-year experience. *Aesthetic Plast Surg.* 1991;15:321–326.
18. Guerrerosantos J, Gonzalez-Mendoza A, Masmela Y, et al. Long-term survival of free fat grafts in muscle: an experimental study in rats. *Aesthetic Plast Surg.* 1996;20:403–408.
19. Torio-Padron N, Baerlecken N, Momeni A, et al. Engineering of adipose tissue by injection of human preadipocytes in fibrin. *Aesthetic Plast Surg.* 2007;31:285–293.
20. Ersek RA. Transplantation of purified autologous fat: a 3-year follow-up is disappointing. *Plast Reconstr Surg.* 1991;87:219–227.
21. Dudas JR, Marra KG, Cooper GM, et al. The osteogenic potential of adipose-derived stem cells for the repair of rabbit calvarial defects. *Ann Plast Surg.* 2006;56:543–548.
22. Har-Shai Y, Lindenbaum ES, Gamliel-Lazarovich A, et al. An integrated approach for increasing the survival of autologous fat grafts in the treatment of contour defects. *Plast Reconstr Surg.* 1999;104:945–954.
23. Mizuno H, Zuk PA, Zhu M, et al. Myogenic differentiation by human processed lipoaspirate cells. *Plast Reconstr Surg.* 2002;109:199–209.
24. Gutowski KA; ASPS Fat Graft Task Force. Current applications and safety of autologous fat grafts: a report of the ASPS fat graft task force. *Plast Reconstr Surg.* 2009;124:272–280.
25. Zheng DN, Li QF, Lei H, et al. Autologous fat grafting to the breast for cosmetic enhancement: experience in 66

patients with long-term follow up. *J Plast Reconstr Aesthet Surg*. 2008;61:792–798.
26. Coleman SR. Structural fat grafts: the ideal filler? *Clin Plast Surg*. 2001;28:111–119.
27. Kaufman MR, Miller TA, Huang C, et al. Autologous fat transfer for facial recontouring: is there science behind the art? *Plast Reconstr Surg*. 2007;119:2287–2296.
28. Coleman SR. Facial augmentation with structural fat grafting. *Clin Plast Surg*. 2006;28:111–119.
29. Yoshimura K, Sato K, Aoi N, et al. Cell-assisted lipotransfer for cosmetic breast augmentation: supportive use of adipose-derived stem/stromal cells. *Aesthetic Plast Surg*. 2008;32:48–55.
30. von Heimburg D, Zachariah S, Low A, et al. Influence of different biodegradable carriers on the in vivo behavior of human adipose precursor cells. *Plast Reconstr Surg*. 2001;108:411–420; discussion 421–422.
31. Pereira LH, Radwanski HN. Fat grafting of the buttocks and lower limbs. *Aesthetic Plast Surg*. 1996;20:409–416.
32. Coleman SR. Structural fat grafting: more than a permanent filler. *Plast Reconstr Surg*. 2006;118(3 Suppl): 108S–120S.
33. Moore JH Jr, Kolaczynski JW, Morales LM, et al. Viability of fat obtained by syringe suction lipectomy: effects of local anesthesia with lidocaine. *Aesthetic Plast Surg*. 1995;19:335–339.
34. Pu LL, Cui X, Fink BF, et al. The viability of fatty tissues within adipose aspirates after conventional liposuction: a comprehensive study. *Ann Plast Surg*. 2005;54:288–292.
35. Ashjian PH, Elbarbary AS, Edmonds B, et al. In vitro differentiation of human processed lipoaspirate cells into early neural progenitors. *Plast Reconstr Surg*. 2003;111:1922–1931.
36. Teimourian B. Blindness following fat injections. *Plast Reconstr Surg*. 1988;82:361.
37. Feinendegen DL, Baumgartner RW, Vuadens P, et al. Autologous fat injection for soft tissue augmentation in the face: a safe procedure? *Aesthetic Plast Surg*. 1998;22:163–167.
38. Peer LA. Loss of weight and volume in human fat grafts: with postulation of a "cell survival theory". *Plast Reconstr Surg*. 1950;5:217–230.
39. De Ugarte DA, Ashjian PH, Elbarbary A, et al. Future of fat as raw material for tissue regeneration. *Ann Plast Surg*. 2003;50:215–219.
40. Wolter TP, von Heimburg D, Stoffels I, et al. Cryopreservation of mature human adipocytes: in vitro measurement of viability. *Ann Plast Surg*. 2005;55:408–413.
41. Coleman SR, Saboeiro AP. Fat grafting to the breast revisited: safety and efficacy. *Plast Reconstr Surg*. 2007;119:775–785; discussion 786–787.
42. Carraway JH, Mellow CG. Syringe aspiration and fat concentration: a simple technique for autologous fat injection. *Ann Plast Surg*. 1990;24:293–296; discussion 297.
43. Schoeller T, Lille S, Wechselberger G, et al. Histomorphologic and volumetric analysis of implanted autologous preadipocyte cultures suspended in fibrin glue: a potential new source for tissue augmentation. *Aesthetic Plast Surg*. 2001;25:57–63.
44. Niechajev I, Sevćuk O. Long-term results of fat transplantation: clinical and histologic studies. *Plast Reconstr Surg*. 1994;94:496–506.
45. Pu LL, Coleman SR, Cui X, et al. Autologous fat grafts harvested and refined by the Coleman technique: a comparative study. *Plast Reconstr Surg*. 2008;122: 932–937.
46. Guerrerosantos J. Simultaneous rhytidoplasty and lipoinjection: a comprehensive aesthetic surgical strategy. *Plast Reconstr Surg*. 1998;102:191–199.
47. Chajchir A, Benzaquen I. Fat-grafting injection for soft-tissue augmentation. *Plast Reconstr Surg*. 1989;84:921–934; discussion 935.
48. Chajchir A, Benzaquen I. Liposuction fat grafts in face wrinkles and hemifacial atrophy. *Aesthetic Plast Surg*. 1986;10:115–117.
49. Mojallal A, Lequeux C, Shipkov C, et al. Improvement of skin quality after fat grafting: clinical observation and an animal study. *Plast Reconstr Surg*. 2009;124:765–774.
50. Ellenbogen R. Free autogenous pearl fat grafts in the face—a preliminary report of a rediscovered technique. *Ann Plast Surg*. 1986;16:179–194.
51. Fagrell D, Eneström S, Berggren A, et al. Fat cylinder transplantation: an experimental comparative study of three different kinds of fat transplants. *Plast Reconstr Surg*. 1996;98:90–96; discussion 97–98.
52. Gonda K, Shigeura T, Sato T, et al. Preserved proliferative capacity and multipotency of human adipose-derived stem cells after long-term cryopreservation. *Plast Reconstr Surg*. 2008;121:401–410.
53. Illouz YG. The fat cell "graft": a new technique to fill depressions. *Plast Reconstr Surg*. 1986;78:122–123.
54. Moscona R, Ullman Y, Har-Shai Y, et al. Free-fat injections for the correction of hemifacial atrophy. *Plast Reconstr Surg*. 1989;84:501–507; discussion 508–509.
55. Hudson DA, Lambert EV, Bloch CE. Site selection for fat autotransplantation: some observations. *Aesthetic Plast Surg*. 1990;14:195–197.
56. Katz AJ, Llull R, Hedrick MH, et al. Emerging approaches to the tissue engineering of fat. *Clin Plast Surg*. 1999;26:587–603, viii.
57. Bircoll M, Novack BH. Autologous fat transplantation employing liposuction techniques. *Ann Plast Surg*. 1987;18:327–329.
58. Serra-Renom JM, Muñoz-Olmo JL, Serra-Mestre JM. Fat grafting in postmastectomy breast reconstruction with expanders and prostheses in patients who have received radiotherapy: formation of new subcutaneous tissue. *Plast Reconstr Surg*. 2010;125:12–18.
59. Moseley TA, Zhu M, Hedrick MH. Adipose-derived stem and progenitor cells as fillers in plastic and reconstructive surgery. *Plast Reconstr Surg*. 2006;118(3 Suppl):121S–128S.
60. Kurita M, Matsumoto D, Shigeura T, et al. Influences of centrifugation on cells and tissues in liposuction aspirates: optimized centrifugation for lipotransfer and cell isolation. *Plast Reconstr Surg*. 2008;121:1033–1041; discussion 1042–1043.
61. Serra-Renom JM, Fontdevila J. Treatment of facial fat atrophy related to treatment with protease inhibitors by autologous fat injection in patients with human immunodeficiency virus infection. *Plast Reconstr Surg*. 2004;114:551–555.
62. Smith P, Adams WP Jr, Lipschitz AH, et al. Autologous human fat grafting: effect of harvesting and preparation techniques on adipocyte graft survival. *Plast Reconstr Surg*. 2006;117:1836–1844.
63. Stosich MS, Mao JJ. Adipose tissue engineering from human adult stem cells: clinical implications in plastic and reconstructive surgery. *Plast Reconstr Surg*. 2007;119:71–83; discussion 84–85.
64. Khouri R, Del Vecchio D. Breast reconstruction and augmentation using pre-expansion and autologous fat transplantation. *Clin Plast Surg*. 2009;36:269–280, viii.

65. Rohrich RJ, Sorokin ES, Brown SA. In search of improved fat transfer viability: a quantitative analysis of the role of centrifugation and harvest site. *Plast Reconstr Surg.* 2004;113:391–395.
66. Carpaneda CA, Ribeiro MT. Study of the histologic alterations and viability of the adipose graft in humans. *Aesthetic Plast Surg.* 1993;17:43–47.
67. Rigotti G, Marchi A, Stringhini P, et al. Determining the oncological risk of autologous lipoaspirate grafting for post-mastectomy breast reconstruction. *Aesthetic Plast Surg.* 2010;34:475–480.
68. Kononas TC, Bucky LP, Hurley C, et al. The fate of suctioned and surgically removed fat after reimplantation for soft-tissue augmentation: a volumetric and histologic study in the rabbit. *Plast Reconstr Surg.* 1993;91:763–768.
69. Eppley BL, Sidner RA, Platis JM, et al. Bioactivation of free-fat transfers: a potential new approach to improving graft survival. *Plast Reconstr Surg.* 1992;90:1022–1030.
70. Lu F, Li J, Gao J, et al. Improvement of the survival of human autologous fat transplantation by using VEGF-transfected adipose-derived stem cells. *Plast Reconstr Surg.* 2009;124:1437–1446.
71. Coleman SR. Hand rejuvenation with structural fat grafting. *Plast Reconstr Surg.* 2002;110:1731–1744; discussion 1745–1747.
72. Ramon Y, Shoshani O, Peled IJ, et al. Enhancing the take of injected adipose tissue by a simple method for concentrating fat cells. *Plast Reconstr Surg.* 2005;115:197–201; discussion 202–203.
73. Gonzalez AM, Lobocki C, Kelly CP, et al. An alternative method for harvest and processing fat grafts: an in vitro study of cell viability and survival. *Plast Reconstr Surg.* 2007;120:285–294.
74. Bircoll M. Cosmetic breast augmentation utilizing autologous fat and liposuction techniques. *Plast Reconstr Surg.* 1987;79:267–271.
75. Klinger M, Marazzi M, Vigo D, et al. Fat injection for cases of severe burn outcomes: a new perspective of scar remodeling and reduction. *Aesthetic Plast Surg.* 2008;32:465–469.
76. Cárdenas-Camarena L, Lacouture AM, Tobar-Losada A. Combined gluteoplasty: liposuction and lipoinjection. *Plast Reconstr Surg.* 1999;104:1524–1531.
77. Hörl HW, Feller AM, Biemer E. Technique for liposuction fat reimplantation and long-term volume evaluation by magnetic resonance imaging. *Ann Plast Surg.* 1991;26:248–258.
78. Guerrerosantos J. Long-term outcome of autologous fat transplantation in aesthetic facial recontouring: sixteen years of experience with 1936 cases. *Clin Plast Surg.* 2000;27:515–543.
79. Baran CN, Celebioğlu S, Sensöz O, et al. The behavior of fat grafts in recipient areas with enhanced vascularity. *Plast Reconstr Surg.* 2002;109:1646–1651.
80. Lee JA, Parrett BM, Conejero JA, et al. Biological alchemy: engineering bone and fat from fat-derived stem cells. *Ann Plast Surg.* 2003;50:610–617.
81. Tholpady SS, Llull R, Ogle RC, et al. Adipose tissue: stem cells and beyond. *Clin Plast Surg.* 2006;33:55–62, vi.
82. Hyakusoku H, Ogawa R, Ono S, et al. Complications after autologous fat injection to the breast. *Plast Reconstr Surg.* 2009;123:360–370; discussion 371–372.
83. Spear SL, Wilson HB, Lockwood MD. Fat injection to correct contour deformities in the reconstructed breast. *Plast Reconstr Surg.* 2005;116:1300–1305.
84. Carpaneda CA, Ribeiro MT. Percentage of graft viability versus injected volume in adipose autotransplants. *Aesthetic Plast Surg.* 1994;18:17–19.
85. Marra KG, Defail AJ, Clavijo-Alvarez JA, et al. FGF-2 enhances vascularization for adipose tissue engineering. *Plast Reconstr Surg.* 2008;121:1153–1164.
86. Schipper BM, Marra KG, Zhang W, et al. Regional anatomic and age effects on cell function of human adipose-derived stem cells. *Ann Plast Surg.* 2008;60:538–544.
87. Chajchir A. Fat injection: long-term follow-up. *Aesthetic Plast Surg.* 1996;20:291–296.
88. Trepsat F. Periorbital rejuvenation combining fat grafting and blepharoplasties. *Aesthetic Plast Surg.* 2003;27:243–253.
89. Yuksel E, Weinfeld AB, Cleek R, et al. Increased free fat-graft survival with the long-term, local delivery of insulin, insulin-like growth factor-I, and basic fibroblast growth factor by PLGA/PEG microspheres. *Plast Reconstr Surg.* 2000;105:1712–1720.
90. Ersek RA, Chang P, Salisbury MA. Lipo layering of autologous fat: an improved technique with promising results. *Plast Reconstr Surg.* 1998;101:820–826.
91. Castelló JR, Barros J, Vázquez R. Giant liponecrotic pseudocyst after breast augmentation by fat injection. *Plast Reconstr Surg.* 1999;103:291–293.
92. Loeb R. Fat pad sliding and fat grafting for leveling lid depressions. *Clin Plast Surg.* 1981;8:757–776.
93. Guerrerosantos J. Autologous fat grafting for body contouring. *Clin Plast Surg.* 1996;23:619–631.
94. Lewis CM. Correction of deep gluteal depression by autologous fat grafting. *Aesthetic Plast Surg.* 1992;16:247–250.
95. Kaufman MR, Bradley JP, Dickinson B, et al. Autologous fat transfer national consensus survey: trends in techniques for harvest, preparation, and application, and perception of short- and long-term results. *Plast Reconstr Surg.* 2007;119:323–331.
96. Chajchir A, Benzaquen I, Wexler E, et al. Fat injection. *Aesthetic Plast Surg.* 1990;14:127–136.
97. Pinsolle V, Chichery A, Grolleau JL, et al. Autologous fat injection in Poland's syndrome. *J Plast Reconstr Aesthet Surg.* 2008;61:784–791.
98. Boschert MT, Beckert BW, Puckett CL, et al. Analysis of lipocyte viability after liposuction. *Plast Reconstr Surg.* 2002;109:761–765; discussion 766–767.
99. Zhu M, Zhou Z, Chen Y, et al. Supplementation of fat grafts with adipose-derived regenerative cells improves long-term graft retention. *Ann Plast Surg.* 2010;64:222–228.
100. Loeb R. Naso-jugal groove leveling with fat tissue. *Clin Plast Surg.* 1993;20:393–400.
101. Illouz YG. Present results of fat injection. *Aesthetic Plast Surg.* 1988;12:175–181.
102. Ullmann Y, Hyams M, Ramon Y, et al. Enhancing the survival of aspirated human fat injected into nude mice. *Plast Reconstr Surg.* 1998;101:1940–1944.
103. Zocchi ML, Zuliani F. Bicompartmental breast lipostructuring. *Aesthetic Plast Surg.* 2008;32:313–328.
104. Matsudo PK, Toledo LS. Experience of injected fat grafting. *Aesthetic Plast Surg.* 1988;12:35–38.
105. Kesselring UK. Regional fat aspiration for body contouring. *Plast Reconstr Surg.* 1983;72:610–619.
106. Toledo LS, Mauad R. Fat injection: a 20-year revision. *Clin Plast Surg.* 2006;33:47–53, vi.
107. Peer LA. The neglected free fat graft, its behavior and clinical use. *Am J Surg.* 1956;92:40–47.
108. Illouz YG, Sterodimas A. Autologous fat transplantation to the breast: a personal technique with 25 years of experience. *Aesthetic Plast Surg.* 2009;33:706–715.
109. Vaienti L, Soresina M, Menozzi A. Parascapular free flap and fat grafts: combined surgical methods in morpho-

logical restoration of hemifacial progressive atrophy. *Plast Reconstr Surg.* 2005;116:699–711.
110. Locke MB, de Chalain TM. Current practice in autologous fat transplantation: suggested clinical guidelines based on a review of recent literature. *Ann Plast Surg.* 2008;60:98–102.
111. Villani F, Caviggioli F, Giannasi S, et al. Current applications and safety of autologous fat grafts: a report of the ASPS Fat Graft Task Force. *Plast Reconstr Surg.* 2010;125:758–759.
112. Khouri RK, Eisenmann-Klein M, Cardoso E, et al. Brava and autologous fat transfer is a safe and effective breast augmentation alternative: results of a 6-year, 81-patient, prospective multicenter study. *Plast Reconstr Surg.* 2012;129:1173–1187.
113. Picknett T, Davis K. The 100 most-cited articles from JMB. *J Mol Biol.* 1999;293:171–176.
114. Bohannon RW, Roberts D. Core journals of rehabilitation: identification through index analysis. *Int J Rehabil Res.* 1991;14:333–336.
115. Joyce CW, Sugrue CM, Joyce KM, et al. 100 citation classics in the melanoma literature: a bibliometric analysis. *Dermatol Surg.* 2014;40:1284–1298.
116. Rodrigues MA, Tedesco AC, Nahas FX, et al. Journal impact factor versus the evidence level of articles published in plastic surgery journals. *Plast Reconstr Surg.* 2014;133:1502–1507.
117. Offer GJ, Perks AG. In search of evidence-based plastic surgery: the problems faced by the specialty. *Br J Plast Surg.* 2000;53:427–433.
118. Khouri RK, Rigotti G, Cardoso E, et al. Megavolume autologous fat transfer: part II. Practice and techniques. *Plast Reconstr Surg.* 2014;133:1369–1377.
119. Longaker MT, Aston SJ, Baker DC, et al. Fat transfer in 2014: what we do not know. *Plast Reconstr Surg.* 2014;133:1305–1307.
120. Mende K, Strub B, Meuli-Simmen C. Autologous fat grafting for painful finger scars. *J Hand Surg Eur Vol.* 2014 Jul 10. [Epub ahead of print].
121. Bank J, Fuller SM, Henry GI, et al. Fat grafting to the hand in patients with Raynaud phenomenon: a novel therapeutic modality. *Plast Reconstr Surg.* 2014;133:1109–1118.
122. Vercler CJ, Ballard TN, Buchman SR. Conjunctival fat grafting for improved aesthetics of an ocular prosthesis. *J Plast Reconstr Aesthet Surg.* 2014;67:575–576.
123. Garza RM, Paik KJ, Chung MT, et al. Studies in fat grafting: Part III. Fat grafting irradiated tissue—improved skin quality and decreased fat graft retention. *Plast Reconstr Surg.* 2014;134:249–257.