

The 100 Most-Cited Articles in Liposuction

A Bibliometric Analysis

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Background: Liposuction is one of the most common cosmetic surgical procedures performed worldwide. Despite previous citation analyses in plastic surgery, the most-cited works in liposuction have not yet been qualitatively or quantitatively appraised. We hypothesized that use of validated outcome measures and levels of evidence would be low among these articles. Thus, we performed a bibliometric analysis aiming to comprehensively review the most-cited liposuction literature, evaluating characteristics and quality of the top 100 articles.

Methods: The 100 most-cited articles in liposuction were identified on Web of Science, across all available journals and years (1950–2020). Study details, including the citation count, main subject, and outcome measures, were extracted from each article by 2 independent reviewers. The level of evidence of each study was also assessed.

Results: The 100 most-cited articles in liposuction were cited by a total of 4809 articles. Citations per article ranged from 602 to 45 (mean, 92). Most articles were level of evidence 4 (n = 33) or 5 (n = 35), representative of the large number of case series, expert-opinion articles, and narrative reviews. Ten articles achieved level of evidence 3, 22 articles achieved level of evidence 2, and none reached level 1. The main subject was operative technique in 63 articles, followed by outcomes in 32 articles. Five articles assessed the metabolic effects of liposuction. Only 1 article used a validated objective cosmetic outcome measure, and none used validated patient-reported outcome measures.

Conclusions: This analysis provides an overview of the top cited liposuction literature. Overall, level of evidence was low, and no articles achieved the highest level of evidence. Improving the quality of literature requires prioritization of better-designed studies and incorporation of validated outcome measures, which will increase patient satisfaction and ensure provision of excellent, reproducible clinical care.

Key Words: plastic surgery, cosmetics, lipectomy, health care outcome assessment, bibliometrics

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Liposuction is the second most common cosmetic surgical procedure in the United States of America with procedural expenditure exceeding \$1 billion.^{1,2} Nonetheless, although plastic surgery has made significant attempts to increase the quality of literature,³ adoption of evidence-based medicine principles has been slow.^{4,5}

The number of citations is a direct measure of the impact and relevance of scientific articles.⁶ Citation metrics influence the reputation of authors, institutions, and journals, and in an attempt to drive high-impact

research, funding bodies may use citation numbers to support grant allocation decisions.⁶ Bibliometric analysis allows qualitative and quantitative evaluation of research outputs, providing historical perspective and insights into seminal publications.

Several bibliometric analyses of the plastic and reconstructive surgery literature exist,^{7–15} but there has not yet been a comprehensive, objective examination of the most-cited works focusing on liposuction. These previous analyses highlighted a paucity of validated outcome measures¹⁵ and low levels of evidence.^{7,8,12,15} We hypothesized that similar trends may be observed across the most-cited liposuction literature. Knowledge of qualitative and quantitative features of influential research underpinning liposuction is crucial for surgeons, both to contextualize their clinical practice and help shape future research priorities. Therefore, we performed a bibliometric analysis of published articles on liposuction, aiming to provide narrative synthesis, in addition to evaluating both characteristics and quality of the top 100 cited articles.

METHODS

A literature review was performed to identify the 100 most-cited articles on liposuction. All available journals on the online database, Web of Science (version 5.33; Clarivate Analytics), were searched using the following search strategy: “liposuction” OR “suction lipectomy” OR “suction-assisted lipectomy” OR “lipoectomy” OR “lipoplasty” OR “liposculpture” as a “topic” on October 15, 2020. The time span set encompassed all years available (1950–2020).

The search yielded 4060 articles, which were subsequently ranked in descending order of times cited. Articles with an equal number of citations were separated by the average number of citations per year, with the more recent articles ranking higher. To ensure that the articles were directly relevant to liposuction, 2 reviewers (RKR and AD) independently screened titles and abstracts until 100 articles were included. Discrepancies were resolved by consensus discussion with the senior author (AK), with any remaining doubts settled by a review of the publication's full text. A total of 351 articles were screened to provide 100 articles for inclusion. Reasons for exclusion of the other articles are specified in Figure 1.

Data were independently extracted from full-text articles by 2 authors (RKR and AD) and entered onto a standardized computer spreadsheet (Microsoft Excel, version 14.7.7). Data extraction included article title, authors, publication year, source journal, total citations, mean number of citations per year, study setting, funding status, study design, level of evidence, main subject, and the use of clinical, cosmetic and patient-reported outcome measures (PROMs). Level of evidence was assessed as per the Oxford Centre for Evidence-Based Medicine system (2011).¹⁶

RESULTS

Citation Analyses

A total of 4809 articles cited the top 100 most highly cited articles on liposuction. The highest-cited article was cited 602 times. The endmost article listed accrued a total of 45 citations. The mean number of citations per article was 92. Mean number citation analysis per article per year highlighted a range from 30.3 to 1.3 (mean, 4.8) (Table 1).

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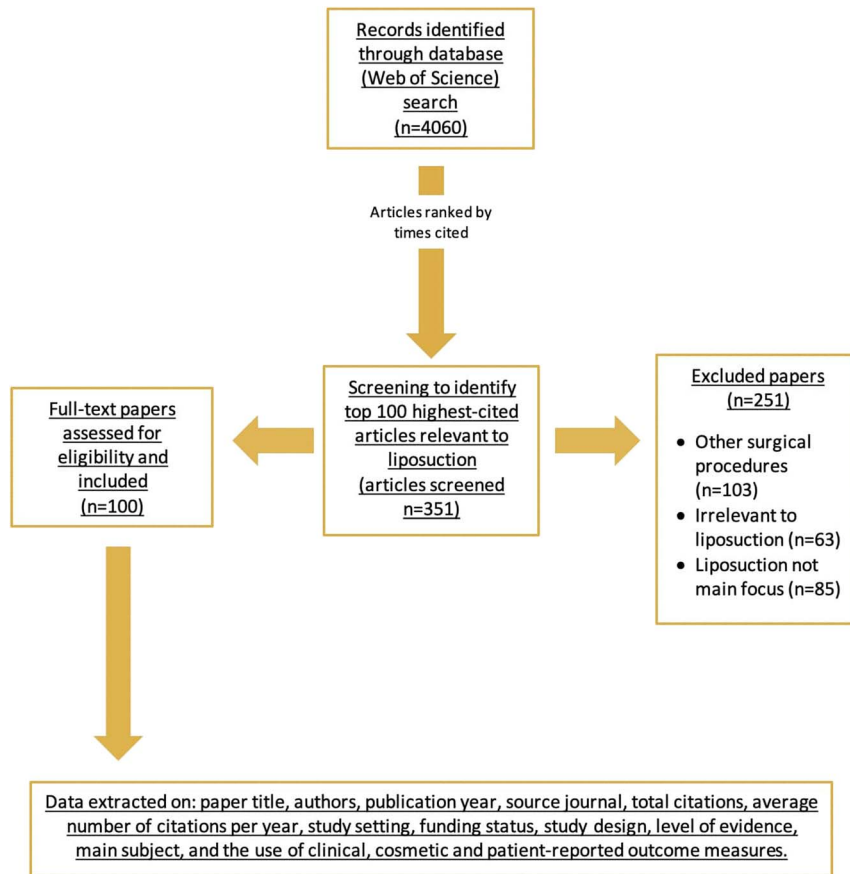


FIGURE 1. Flowchart summarizing methodology. full color online

The highest-cited article on the list was a case series, published by Coleman¹⁷ in 1997, entitled “Facial recontouring with liposuction.” The author with the highest number of most-cited publications was Brorson with 7 articles (all first author), jointly followed by Klein with 6 articles (all first author) and Rohrich (5 first author and 1 coauthor).

Most of the highest cited articles were published between 1990 and 2000 (n = 45), with the other decades producing smaller outputs (Fig. 2). This decade also contributed the highest-cited article. The second most productive decade was the 2000s (n = 37). The decade with the least output was 2010 onward (n = 7).

Prevalent Research Themes

The top 100 articles were derived from a total of 23 journals. The most prolific journal was *Plastic and Reconstructive Surgery* (PRS) (n = 41), followed by *Aesthetic Plastic Surgery* (n = 14). The other journals contributed less than 10 articles each (see Supplemental Digital Content 2, <http://links.lww.com/SAP/A685>, where the journals contributing the 100 most-cited articles are tabulated).

Cumulatively, plastic surgery was the main subject in 4 of the journals on the list. All remaining journals focused on a different discipline. Single-center study designs (n = 87) were more commonly used than multicenter designs (n = 13). All 13 multicenter studies were performed in the United States. The highest output of articles was also produced by United States overall (n = 58), followed jointly by Brazil and Sweden with 7 articles each (see Supplemental Digital Content 3, <http://links.lww.com/SAP/A686>, where the countries contributing the 100 most-cited articles are tabulated). Receipt of funding was formally reported in 15 articles. Remaining

articles either did not declare funding status (n = 78) or were unfunded (n = 7).

The main subject in most of the articles was technique (n = 63), 50 surgical and 13 perioperative, although a significant proportion focused on outcomes (n = 32) (Supplemental Digital Content 4, <http://links.lww.com/SAP/A687>). Articles on technique focused on the core liposuction technique itself (n = 37) and prominent cosmetic and noncosmetic applications of the liposuction procedure (n = 26) (Fig. 3). Prognostic studies commonly investigated metabolic and cardiovascular effects of liposuction in patients (n = 5).

Methodological Quality

Many articles were assessed to be level of evidence 4 (n = 33) or 5 (n = 35), which is representative of the large number of case series, in addition to expert-opinion articles and narrative reviews. Ten articles achieved level of evidence 3, and 22 articles level of evidence 2, although no article reached level of evidence 1 (Fig. 4). The most common study types were case series (n = 30), expert opinions (n = 15), quasiexperiments (n = 12), and cohort studies (n = 11; 7 retrospective and 4 prospective), respectively (Fig. 5). The remainder of studies used study designs with less than 10 articles in each (Fig. 5).

The proportion of articles with level of evidence 3 increased consecutively with each decade. A decreasing proportion of level of evidence 4 articles was simultaneously observed. Articles at level of evidence 2 increased in proportion in 2000, when compared with 1990s and 1980s. As 2010s onward comprised of relatively few articles (n = 7), no firm level of evidence trends could be evaluated.

TABLE 1. The 100 Most-Cited Articles on Liposuction Ordered by Total Number of Citations

Rank	Study	Total Citations	Mean Citations/Year
1	Coleman ¹	602	26.17
2	Klein et al ²	485	30.31
3	Klein ³	315	10.50
4	Lejour ⁴	271	10.42
5	Klein ⁵	258	9.56
6	Grazer and de Jong ⁶	199	9.95
7	Rao et al ⁷	171	8.14
8	Hanke et al ⁸	170	6.80
9	Ostad et al ⁹	164	6.83
10	Klein ¹⁰	159	5.30
11	Teimourian and Rogers ¹¹	146	4.71
12	Rohrich et al ¹²	141	8.29
13	Brorson and Svensson ¹³	137	6.23
14	Housman et al ¹⁴	134	7.44
15	Lillis ¹⁵	112	3.50
16	Matarasso ¹⁶	109	4.36
17	Dillerud ¹⁷	108	3.60
18	Meyers et al ¹⁸	107	5.94
19	Neira et al ¹⁹	107	5.94
20	Zocchi ²⁰	106	4.42
21	Klein ²¹	101	3.16
22	Chaouat et al ²²	101	5.05
23	Matarasso ²³	99	3.41
24	Badin et al ²⁴	98	5.44
25	Giugliano et al ²⁵	97	6.06
26	Rohrich et al ²⁶	96	4.17
27	Rohrich et al ²⁷	94	4.27
28	Goldman ²⁸	94	6.71
29	Kim and Stevenson ²⁹	94	6.71
30	Matarasso et al ³⁰	91	6.50
31	Zelickson et al ³¹	91	8.27
32	Murillo et al ³²	85	4.25
33	Prado et al ³³	85	6.07
34	Brorson et al ³⁴	83	3.77
35	Ichikawa et al ³⁵	81	5.40
36	Brorson and Svensson ³⁶	79	3.43
37	Gasparotti ³⁷	78	2.79
38	Burk et al ³⁸	78	3.25
39	Gilliland and Coates ³⁹	77	3.35
40	Trott et al ⁴⁰	75	3.41
41	Iverson and Lynch ⁴¹	75	4.69
42	Teitelbaum et al ⁴²	75	5.77
43	Giese et al ⁴³	73	3.84
44	Pitman and Teimourian ⁴⁴	71	2.03
45	Apfelberg et al ⁴⁵	71	2.73
46	Badin et al ⁴⁶	71	4.73
47	Commons et al ⁴⁷	69	3.63
48	Rosenberg ⁴⁸	68	2.06
49	Maxwell and Gingras ⁴⁹	68	3.09
50	Matarasso ⁵⁰	68	3.40
51	Saldanha et al ⁵¹	68	4.00
52	Cárdenas-Camarena et al ⁵²	64	3.05

Continued next page

TABLE 1. (Continued)

53	Mulholland et al ⁵³	64	7.11
54	Brorson et al ⁵⁴	63	4.50
55	Samdal et al ⁵⁵	62	2.38
56	Ou et al ⁵⁶	62	2.82
57	Ross and Johnson ⁵⁷	61	1.91
58	Mordon et al ⁵⁸	61	5.08
59	Damstra et al ⁵⁹	61	5.55
60	Apfelberg ⁶⁰	59	2.46
61	Brorson ⁶¹	59	2.95
62	Di Martino et al ⁶²	59	5.90
63	Laub and Laub ⁶³	58	1.93
64	Toledo ⁶⁴	58	2.00
65	Fodor and Watson ⁶⁵	58	2.64
66	Klein and Kassarijian ⁶⁶	56	2.43
67	Lee et al ⁶⁷	56	4.00
68	Khan ⁶⁸	56	4.67
69	Courtiss ⁶⁹	55	1.53
70	Rohrich et al ⁷⁰	55	3.24
71	Courtiss et al ⁷¹	54	1.93
72	Gonzalez-Ortiz et al ⁷²	54	3.00
73	Saldanha et al ⁷³	54	4.91
74	Fatemi and Kane ⁷⁴	54	5.40
75	Avci et al ⁷⁵	53	7.57
76	Dillerud ⁷⁶	52	1.79
77	Giampapa and Bernardo ⁷⁷	52	2.08
78	Pitman et al ⁷⁸	52	2.17
79	Barillo et al ⁷⁹	52	2.36
80	Schmeller et al ⁸⁰	52	6.50
81	Christman ⁸¹	51	1.50
82	O'Brien et al ⁸²	50	1.61
83	Lillis and Coleman ⁸³	50	1.67
84	Coleman et al ⁸⁴	50	2.38
85	Rohrich and Beran ⁸⁵	50	2.38
86	Perng et al ⁸⁶	50	3.13
87	Heller et al ⁸⁷	50	4.17
88	Mohammad et al ⁸⁸	50	4.17
89	Coleman ⁸⁹	49	1.53
90	Tsai and Lin ⁹⁰	49	2.58
91	Grazer ⁹¹	48	1.30
92	Fodor ⁹²	48	1.92
93	Gasperoni and Salgarello ⁹³	47	1.88
94	Man et al ⁹⁴	47	2.24
95	Starling et al ⁹⁵	47	5.88
96	Samdal et al ⁹⁶	46	1.77
97	Weinberg et al ⁹⁷	46	2.00
98	Brorson et al ⁹⁸	46	3.83
99	Brorson ⁹⁹	46	11.50
100	Illouz ¹⁰⁰	45	1.61

Complete citations for all 100 most-cited articles are provided in Supplemental Digital Content 1, <http://links.lww.com/SAP/A684>.

Eighty-six of the most-cited articles used clinical outcome measures. Although 76 articles reported objective outcomes, only 1 used a validated objective cosmetic outcome measure, namely, the Strasser scale.¹⁸ Fifty-one articles reported subjective outcomes, but none used

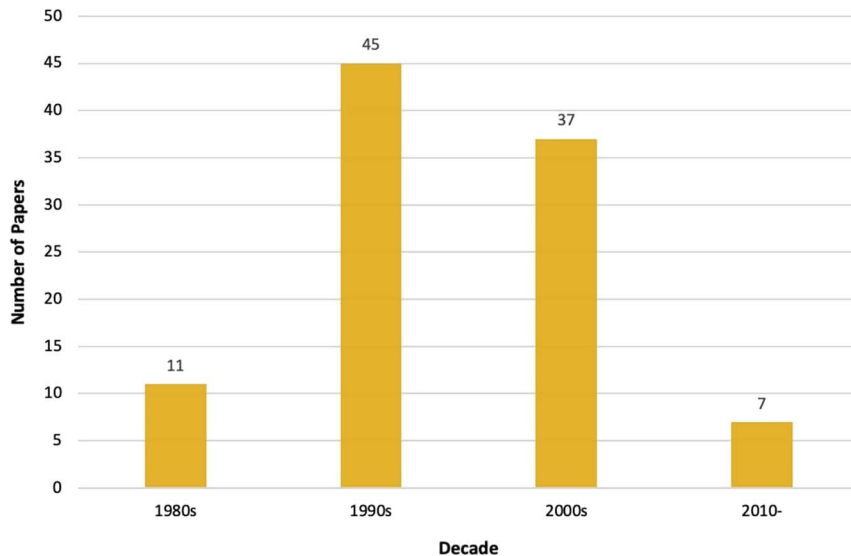


FIGURE 2. One hundred most-cited articles—decade analysis. [full color online](#)

validated PROMs. Forty-two articles reported preoperative and postoperative photographs as outcomes.

DISCUSSION

This is the first bibliometric analysis in available literature evaluating the most-cited articles published on liposuction. Over half of the 100 most-cited articles were published in plastic surgery journals. The 100 most-cited articles primarily described technical operative considerations, were mostly single-center, and originated from the United

States. Articles discussing noncosmetic applications of liposuction were prominent. No studies achieved level 1 evidence, and the 3 most common study designs were case series, expert opinion pieces, and quasiexperimental studies. Only 1 study reported a validated objective cosmetic outcome measure, and no studies used validated PROMs.

The most-cited article by Coleman¹⁷ in 1997 was a case series presenting liposculpture, a method of autologous fat transplantation for facial recontouring. Although Coleman^{19,20} had published earlier on liposculpture, this article is notable for meticulous descriptions of careful harvesting, atraumatic transportation, and appropriate

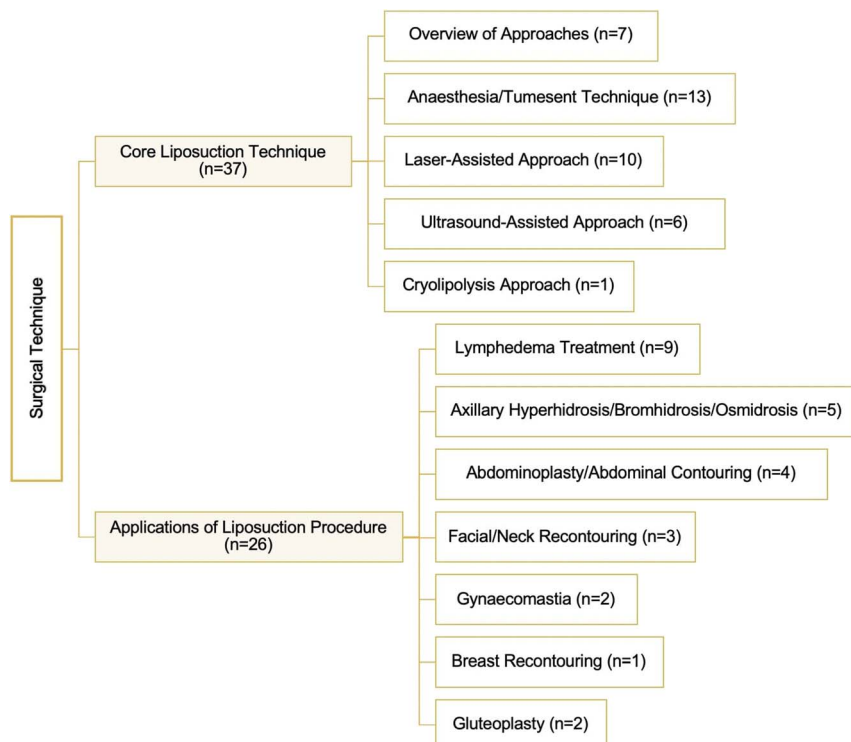


FIGURE 3. Subcategorization of articles with “surgical technique” as the main subject within the 100 most-cited articles. [full color online](#)

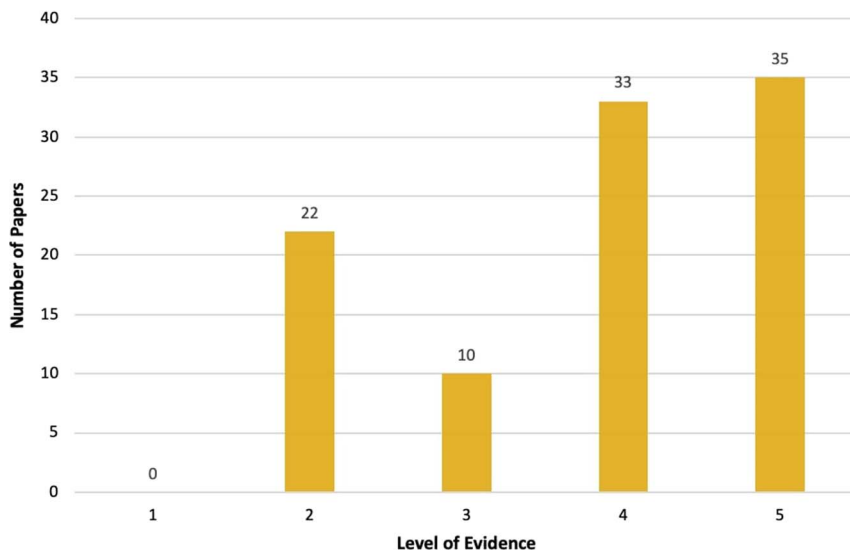


FIGURE 4. One hundred most-cited articles—levels of evidence. [full color online](#)

infiltration alongside impressive photographic results. Comprehensive explanations of applied adipose anatomy and physiology provide a comprehensive background to the elegant technique. This article likely laid the foundations for the increasing prevalence of autologous fat grafting in recent years²¹ by providing clear, detailed education in its nuances.

The second most-cited article assessed the effect of large-volume liposuction on risk factors for coronary heart disease and insulin sensitivity in women with abdominal obesity.²² The demonstration of the absent therapeutic effect of liposuction by Klein and colleagues²² suggested mechanisms by which diet, pharmacotherapy, and bariatric surgery impact metabolic parameters are more complex than simple reductions in fat mass. This work is not only seminal in the plastic surgery literature but also has great relevance to the wider medical field, evidenced by publication in the *New England Journal of Medicine*, the highest-impact factor general medical journal. Four other top-cited articles in the present analysis also assessed metabolic effects.^{23–26}

These data reinforce the long-held concept that liposuction should not be considered a treatment for generalized obesity and its sequelae.

In the third most-cited article, Klein²⁷ described his tumescent technique of liposuction, characterized by infiltration of large volumes of very dilute lidocaine, epinephrine, and sodium bicarbonate. Advantages include minimal blood loss, prolonged local anesthetic benefits with zero general anesthetic risk, and rapid postoperative recovery. This work, along with the 10th most-cited article by Ostad et al²⁸ was groundbreaking, as they challenged the historical dogma of recommended lidocaine doses through detailed documentation of safety with higher doses, ushering in a new era of large-volume liposuction. Six of the top 20 articles focused on the tumescent technique, underlining intense research attention to this method.

Interest in tumescent liposuction was largely driven by large concerns for patient safety and desire to reduce complications, a prominent subject across the most-cited liposuction articles. The sixth,²⁹ eighth,³⁰ eleventh,³¹ and fourteenth³² most-cited articles were

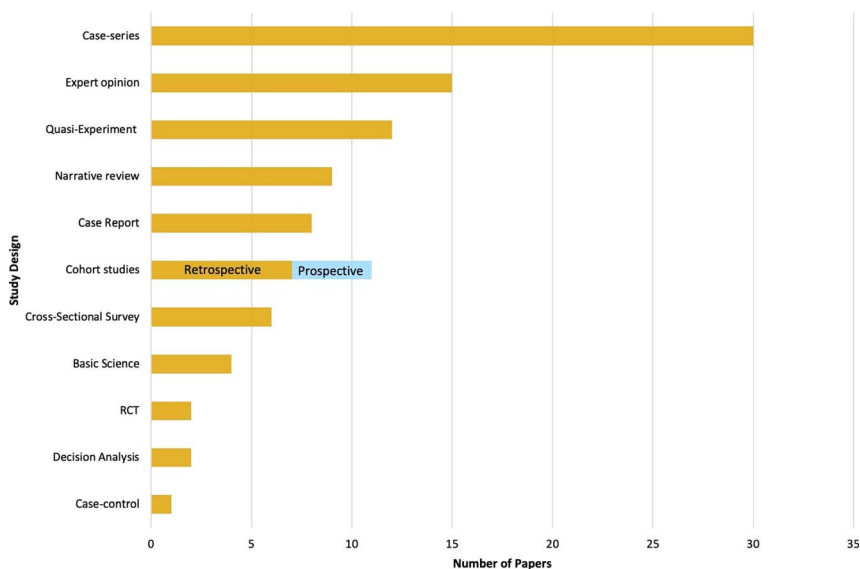


FIGURE 5. One hundred most-cited articles—study designs. [full color online](#)

national cross-sectional surveys assessing safety and complication rates. Reports of serious outcomes in these and top-cited case reports, such as pulmonary emboli, pulmonary edema, fat embolism syndrome, ventricular arrhythmias, and mortality emphasized that, although liposuction is generally safe, it is not entirely without risk. The seventh most-cited article examined liposuction-related deaths and further stressed the wide-reaching significance of safety in liposuction through publication in *New England Journal of Medicine*.³³ Although generally rare, any serious complication in an elective cosmetic procedure is unacceptable, and adopting methods of reducing operative risk are a prerequisite for safe practice.³⁴

Fifteen of the 100 most-cited articles focused on newer, noninvasive methods of body contouring such as ultrasound and laser energy. Zocchi,³⁵ the pioneer of US ultrasound-assisted liposuction contributed its most-cited article, an elaborate thesis encompassing physical principles, surgical technique, and clinical experience. The most-cited article discussing laser-assisted liposuction reported the creation of a transitory pore on the adipocyte membrane as a putative mechanism of action.³⁶ Later experiments failed to replicate this finding,³⁷ highlighting that “most-cited” articles are not always definitive but may be highly cited by virtue of controversy.

Interestingly, several noncosmetic themes emerged. The most prolific author, Brorson, played a substantial role in developing and validating liposuction in treatment of arm lymphedema after breast cancer therapy. Another major application of liposuction includes treatment of axillary hyperhidrosis, bromhidrosis, and osmidrosis, described in 5 articles. Liposuction as a therapy for gynecomastia was discussed in the 13th most-cited article and one other. These conditions are associated with considerable psychological distress and morbidity,^{38–40} and although primarily considered a cosmetic procedure, clinicians should be aware of the noncosmetic potential for improvement of patients' psychosocial functioning.

Generally, the liposuction literature is representative of broader trends across academic plastic surgery. Loonen and colleagues⁷ previously reported on highly cited plastic surgery articles, which are concordant with the present results in terms of most common journal (*PRS*), country of origin (United States), common topics (surgical technique), predominance of single-center data and low levels of evidence, and PROMs. These similarities are also seen in rhinoplasty research, suggesting that areas of interest and features of highly cited plastic surgery articles are similar and reproducible, likely reflecting convergent interests of authors, journals, and the scientific community.¹⁵

The greatest period of productivity in the liposuction literature spanned the period between 1990 and 2010, reflecting a burgeoning interest in the procedure after its initial development. Relatively low contributions from 2010 onward may be due to an exclusion bias favoring older articles, as new articles are generally not cited until 1 to 2 years postpublication, with citation count generally peaking at 3 to 10 years.⁶ It is therefore likely that many newer articles have not yet accumulated the prerequisite number of citations for inclusion within this bibliometric analysis.

In the present analysis, low overall levels of evidence but a recent trend toward increasing levels were observed, agreeing with other similar analyses.⁸ A small study sample size from 2010 onward precluded analysis of this decade. Our findings reflect the dearth of studies achieving the top level of evidence in plastic surgery overall.^{3–5,8,41,42} In an analysis of level 1 aesthetic surgery studies, liposuction only contributed 11% of articles, lagging behind breast augmentation, abdominoplasty, and rhinoplasty.⁴¹ Randomized controlled trials (RCTs) are not always feasible in plastic surgery because of financial, logistical, and ethical constraints, alongside issues related to blinding, inconsistent care provider expertise, and centers' volume.⁴³ However, even when performed, they are often poorly conducted and reported, with the majority failing to randomize, describe randomization processes, or perform power analyses.³ Similarly, the 2 RCTs^{24,44} in our analysis only represent evidence level 2 studies by

virtue of failure to blind²⁴ and absent power calculation.⁴⁴ Prado et al⁴⁴ should however be commended for the only use of validated objective cosmetic outcome measures (Strasser scale¹⁸) among the most-cited liposuction literature. To improve the quality of literature in liposuction, adherence to Consolidated Standards of Reporting Trials guidelines^{43,45,46} must be viewed as a prerequisite for publication.

When RCTs are unfeasible, researchers should consider cohort or case-control designs to boost the quality of literature.⁵ The commonest design in the most-cited liposuction literature were descriptive case series ($n = 30$), and the absence of controls automatically disqualifies achievement of higher levels of evidence.⁴⁷ Well-designed observational analytic studies should be afforded high priority, as they can surpass poorly designed RCTs and may provide similar results to high-quality RCTs⁴⁸ while being easier to execute.⁵

That no studies reported validated PROMs is unsurprising. The first PROM specifically developed for use in liposuction, the BODY-Q,⁴⁹ was published in 2014, and only 1 article after its inception is included. Therefore, the aforementioned exclusion bias favoring older articles likely explains the lack of PROMs reported.⁶ Nonetheless, failure to evaluate PROMs is an area for urgent improvement in the liposuction literature.⁵⁰ Urso-Baiarda and colleagues⁵¹ argue that improving PROMs must be seen as the *raison d'être* for cosmetic surgery and that, without reference to validated indicators of patient satisfaction, clinical outcome measures are inadequate.

Patient-reported outcome measures are crucial for quality improvement (including benchmarking services), facilitating patient choice, shared decision making, and informed consent.⁵⁰ Furthermore, PROMs can identify patient subgroups less likely to benefit from intervention,⁵⁰ particularly important in liposuction where adequate patient selection is paramount.⁵² The American Society of Plastic Surgeons has recommended that plastic surgeons use specific, valid, and relevant PROMs to provide clinically meaningful data regarding aesthetic procedures.⁵³ Similarly, in the United Kingdom, the Royal College of Surgeons has advised routine collection and reporting of preoperative and postoperative PROMs in liposuction procedures.⁵⁴ These proposals should be mandated by journals publishing liposuction research, particularly in clinical evaluation of the newer noninvasive modalities.

As with other bibliometric analyses, our work obeys Bradford law,^{55–57} a bibliographic concept that postulates that most academics cite articles from the main journals in their field of expertise. Deviation from core subject journals results in reduced citation frequency and impact, hence incentivizing publication within core journals. The resultant downstream effect is that a significant proportion of citations originate from these journals, as shown by major contributions of *PRS* and *Aesthetic Plastic Surgery*, with 41 and 17 top-cited articles, respectively. Previous bibliometric analyses in plastic surgery focused only on high-impact speciality journals,^{7–12} so not restricting our search to a limited number of journals is a considerable strength of our study. This resulted in identifying several articles outside of these core journals that may have otherwise been missed, contextualizing liposuction within the wider literature.

The limitations of this work are inherent to bibliometric analyses, with various potential biases having previously been excellently summarized.⁵⁸ Unconscious biases such as self-citation, in-house review, and national and English language biases exist. More conscious biases that may underlie attempts to gain competitive edges in publication include bias by omission (willfully ignoring literature that weaken proposed arguments), bandwagon bias (ie, “second but most prolific”), and powerful person bias (ensuring journal editors, notable peer reviewers/authors in a field, and members of grant awarding bodies are cited). Therefore, it is incorrect to view highly cited articles as automatically possessing higher quality, and we recommend that each article is assessed individually to ensure robust methodological approaches precede sound conclusions. Furthermore, “obliteration by inclusion,”⁵⁹ whereby classic articles become assumed knowledge

and therefore less cited, may explain the absence of certain articles from this analysis.

Because of the aforementioned limitations, citation frequency analysis should be interpreted with caution when evaluating individual scientists.⁶ However, it is certainly a valid measure of assessing research that has been used and assimilated by many researchers and provides appropriate recognition. The top 100 articles we present have been extremely influential in shaping modern liposuction practice, although there are likely other relevant articles that accrued less citations and have been omitted. However, this list, generated from a comprehensive literature search, serves as an excellent introduction to the “classics” in liposuction. We provide a broad overview and historical perspective on prominent topics that have generated considerable interest among the liposuction community in addition to highlighting deficiencies in the level of evidence.

CONCLUSIONS

This extensive analysis, first in the literature, shows the evolution of liposuction over the past 4 decades, highlighting numerous refinements, safety considerations, and development of noninvasive contouring modalities. Driven by surgical innovation, indications for liposuction have expanded to include noncosmetic applications. Research interest in liposuction beyond plastic surgery is highlighted by publication of 2 of the top 10 most-cited articles in the highest-impact factor general medical journal. Improving the quality of the liposuction literature must involve active prioritization of publication of higher levels of evidence, principally well-designed RCTs, or observational analytic studies. Furthermore, procedure-specific PROMs are of central importance and must be recorded preoperatively and postoperatively. This will be crucial for aligning clinical outcomes with patient satisfaction, providing reproducible, high-quality clinical care, and facilitating shared decision making between the clinician and the patient.

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