

A Bibliometric Analysis of the 100 Most-cited Articles in Rhinoplasty

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Introduction: Citation analysis aims to quantify the importance and influence of a published article within its field. We performed a bibliometric analysis to determine the most highly cited articles within rhinoplasty and their impact on current practice.

Methods: The 100 most-cited articles relating to rhinoplasty, between and inclusive of January 1864 to September 2015, were extracted from Web of Science in October 2015. Title, source journal, publication year, total citations, average citations/year, type of article, level of evidence, country of origin, main focus, use of outcome measures, incorporation into “Selected Readings in Plastic Surgery,” and funding status were recorded.

Results: The total number of citations per article ranged from 61 to 276 (1.5–12.1 average citations per year). Surgical technique was the focus of 53% of articles, particularly those for reconstruction (75%). The United States produced 72% of articles compared with 8% from the United Kingdom. The top 100 articles were published within 20 journals; “Plastic and Reconstructive Surgeons” contributed the most articles (n = 57). None of the articles achieved level 1 or 2 of evidence (Oxford Centre for Evidence-Based Medicine levels of evidence, 2011), with most achieving level 4 evidence (n = 64). Case-series were the most popular methodology (n = 37). Few articles used validated outcome measures (n = 21). Twenty-nine percent were referenced in “selected readings.” Eighty-nine percent were unfunded studies.

Conclusions: These top 100 articles are used in current teaching material and underpin surgical decision making. Developing and using validated objective assessment tools will benefit surgeons, patients, and the greater scientific community in objectively evaluating techniques with the most favorable results. (*Plast Reconstr Surg Glob Open* 2016;4:e820; doi: 10.1097/GOX.0000000000000834; Published online 22 July 2016.)

The nose is considered one of the most prominent features of the face. “Rhinoplasty” refers to surgery of the nose performed to improve both form and function. Procedures on the nose are commonly undertaken by several specialities (Hospital Episode Statistics

show a total of 89,188 “main procedures” undertaken on the nose during 2014 to 2015 in the United Kingdom)¹ with an increasing number of aesthetic surgical procedures being performed (4,878 people in the United Kingdom in 2013; an increase in 17% from the previous year).² Through a series of cases, the Edwin Smith Papyrus thesis was the first to describe and illustrate plastic surgery techniques on the nose.³ The dawn of the “modern” era of rhinoplasty was cultivated by the efforts of Roe, Weir, and Joseph⁴; surgery on the nose subsequently embraced the efforts of several authors, institutions, and countries. With textbooks devoted to the singular topic of rhinoplasty, the

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diverse array of published work can be attributable to the complexity of this particular surgery.

It is difficult to determine the true impact of a single article amidst a vast array of published literature. Citations are a tool used to credit the published work of peers and its relevance to the author's article topic. The number of citations also influences the reputation of the author, their institution, and a journal's impact factor (IF). IF is a measure of the number of citations received over the last year divided by the number of published articles over the past 2 years.⁵ The IF is employed as a proxy for journal quality and is an issue of debate; however, journals with higher IF are seen as more prestigious within their respective scientific community.⁶ Other subspecialties have previously reported most-cited articles relevant to their area,^{7,8} and this distills the important characteristics that are required for research to be highly cited. Historically, people may have cited a large number of references to embellish their work, increase their credibility, or to make an article appear more important than it is.

Citation analysis aims to quantify the importance and influence of a published article within its designated field. Although bibliometric analyses have been performed for the speciality of plastic surgery,⁹ to our knowledge, a structured objective analysis of the "classic" articles in rhinoplasty which also involves the specialities of otorhinolaryngology and maxilla-facial surgery has not been undertaken. Our aim was to perform a bibliometric analysis of rhinoplasty, ascertain the top 100 cited articles, and to examine the characteristics of each article therein.

METHODS

The 100 most-cited articles related to rhinoplasty, between and inclusive of January 1864 to October 2015, were extracted from all available journals through an online database [Web of Science, version 5.16.1, Thomson Reuters (London, UK)] of the Science Citation Index of the Institute for Scientific Information on the November 2015. All top 100 articles have come from the top 20 journals of the many hundreds of journals searched by the Web of Science. The database was searched individually by 3 investigators using the medical subject heading term "rhinoplasty" as a "topic" and cross-checked to ensure repeatability of methods. A total of 15,485 articles were found. A list of 100 articles was created in descending order of "times cited." Two articles that were not directly related to rhinoplasty were replaced with the next 2 most highly cited articles. Articles whose main focus was not rhinoplasty ($n = 2$: breast reconstruction and trans-sphenoidal hypophysectomy) were excluded (Fig. 1). Articles with the same number of total citations were ranked higher when they had a larger number of citations over a fewer number of years.

A single author (Y.S.), using the method of Eberlin et al,⁷ recorded the following: title, source journal, publication year, total citations, average citations per year, type of study, level of evidence, country of origin, main subject, use of outcome measures, funding status, and incorporation into "Selected Readings in Plastic Surgery"¹⁰ (a com-

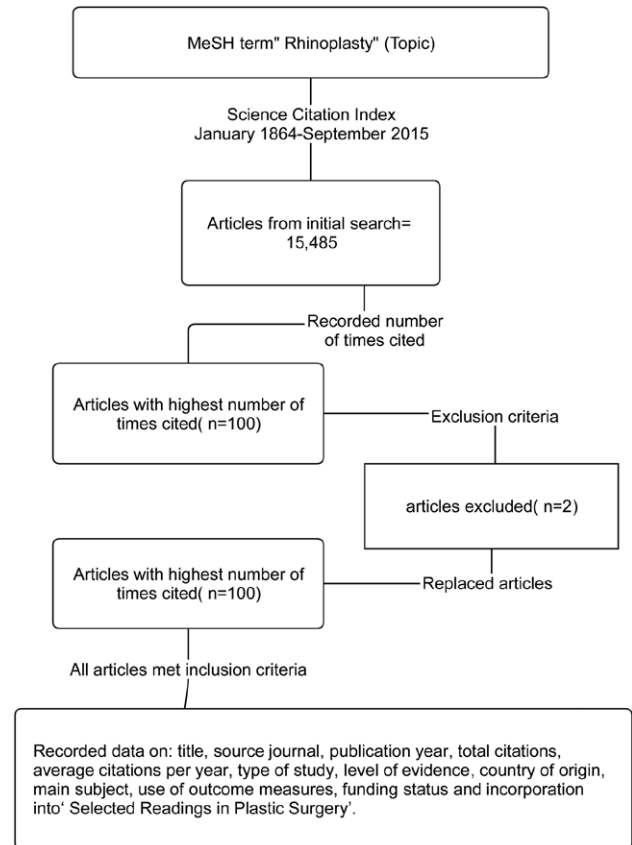


Fig. 1. Summary of methodology in creation of a database on the features of the hundred most-cited articles related to "rhinoplasty."

monly employed, up-to-date, evidence-based guide to modern day plastic surgery practices) were recorded for each article into a computerized spreadsheet (Microsoft Excel 2013, Microsoft Corporation, Wash.). If the main subject of the article was a "technique," then it was subcategorized depending upon the focus of the technique and whether it was undertaken primarily for reconstructive or aesthetic purposes. The level of evidence was categorized according to the Oxford Centre for Evidence-Based Medicine (OCEBM; 2011).¹¹

RESULTS

The 100 most-cited articles were published between 1949 and 2008. Out of all the included journals, only 20 contained the 100 most-cited articles (Table 1). They have been listed in descending order according to the total number of times they have been cited (Table 2). The total number of citations/article ranged from 273 by Burget and Menick¹² on a method to reconstruct the end of the nose to 61 by Guerrerosantos¹³ on the use of temporoparietal free fascia grafts. The mean citations/year ranged from 1.5 to 12.1.

The top 100 articles were published within 20 high IF journals; "Plastic and Reconstructive Surgeons" contributed the majority of articles ($n = 57$). Archives of Otolaryngology—Head and Neck Surgery was the second ($n = 7$), with the remaining journals contributing less than 5 articles each (Table 1). Of the 20 journals' surgical field of

Table 1. Top Journals with Their Individual Contribution to the 100 Most-cited Articles in Rhinoplasty

Rank	Journals	Counts	Journal's Main Speciality	Impact Factor*
1	Plastic and Reconstructive Surgery	56	Plastic surgery	2.99
2	Archives of Otolaryngology—Head and Neck Surgery	7	Otolaryngology/ENT	2.06
3	Laryngoscope	4	Otolaryngology/ENT	2.14
3	Clinics in Plastic Surgery	4	Plastic surgery	0.91
3	British Journal of Plastic Surgery (updated to Journal of Plastic, Reconstructive & Aesthetic Surgery)	4	Plastic surgery	1.42
3	Archives of facial plastic surgery (updated to The Journal of the American Medical Association: Facial Plastic Surgery)	4	Plastic surgery	1.43
7	British Journal of Psychiatry	3	Psychology/psychiatry	7.99
7	Aesthetic Plastic Surgery	3	Plastic surgery	0.96
9	Cleft Palate-Craniofacial Journal	2	Plastic surgery	1.20
9	Archives of Otolaryngology	2	Otolaryngology/ENT	2.33
9	Otolaryngologic Clinics of North America	2	Otolaryngology/ENT	1.49
12	Psychosomatics	1	Psychology/psychiatry	1.86
12	Journal of Steroid Biochemistry and Molecular Biology	1	Basic science	3.63
12	Journal of Psychiatric Research	1	Psychology/psychiatry	3.96
12	Arthritis and Rheumatism	1	Rheumatology	7.76
12	Annals of Plastic Surgery	1	Plastic surgery	1.49
12	Archives of Internal Medicine	1	Medicine	17.33
12	Annals of Otolaryngology and Laryngology	1	Otolaryngology/ENT	1.09
12	Journal of Cranio-Maxillo-Facial Surgery	1	Oral and maxillofacial surgery	2.93
12	Clinical Psychology Review	1	Psychology/psychiatry	6.93

*Official released impact factors found on journal websites as of October 2015.

association, plastic surgery journals were the highest contributors to the top 100 articles ($n = 74$), followed by otolaryngology/ENT ($n = 16$), then by psychology/psychiatry ($n = 6$) with the remaining specialities having only single contributions.

The countries with the highest number of publications were the United States with 72% followed by 8% from the United Kingdom (Table 3). The universities of Texas ($n = 17$), California ($n = 5$), and Pennsylvania ($n = 5$) were placed first, second, and third, respectively (See **Supplemental Digital Content 2**, which displays the institutions most credited by the top 100 cited papers in rhinoplasty, <http://links.lww.com/PRSGO/A235>). Single-center ($n = 76$) work far outnumbered work undertaken at multiple centers ($n = 24$).

The decade with the highest output of highly cited articles was the 1990s, where almost half of the top 100 list originated from ($n = 46$; Fig. 2). The decades of 1970s, 1980s, and 2000s had similar lesser contributions ($n = 17$, 16, and 17, respectively), and the 1960s had the lowest ($n = 4$).

Rohrich¹⁸ was identified as the most prolific author with 8 articles (5 first author and 3 second author) featured in this list, followed by Gunter with 5 first-author articles (See **Supplemental Digital Content 3**, which displays the authors with more than one contribution to the 100 most-cited articles in rhinoplasty, <http://links.lww.com/PRSGO/A236>). Twenty-one authors contributed a total of 58 articles of the top 100 articles.

The most common focus of these 100 articles was surgical technique (53% of articles; Fig. 3), with a larger focus on reconstructive versus aesthetic procedures (3:1 ratio).

None of the articles achieved level 1 or 2 of evidence (Oxford Centre for Evidence-Based Medicine [OCEBM] levels of evidence, 2011). Most work only achieved level 4 evidence ($n = 64$) (Table 4) as a high proportion of the

published literature were case-series ($n = 37$) (Fig. 4). A small number of articles were for experimental studies ($n = 3$), some for narrative literature reviews ($n = 21$) with the majority being clinical studies ($n = 73$), and the remainder were expert opinions and assessment tool validations.

Outcome measures were employed in 72 articles, and validated measures were used in 21 articles (14 objective physician-assessed measures and 25 patient-reported subjective surveys). Of the 72 articles, 47 used photographs as their primary outcome assessment tool. Twenty-nine percent of the articles in our top 100 list were included in the 2015 issue of "Selected Readings in Plastic Surgery—Rhinoplasty."¹⁰ Eighty-nine percent were unfunded studies (ie, formalized sources of funding such as in the form of a grant).

DISCUSSION

Our results demonstrate the characteristics of frequently cited articles within rhinoplasty. There seems to be an increasing number of publications in rhinoplasty by different specialities which demonstrates the modern multidisciplinary approach to management. Plastic, otolaryngology, maxillofacial surgeons, and psychiatrists have their own journals where their respective doctors tend to publish. Analysis of the important articles amidst a growing body of literature can help guide the education and reading material of trainees in an attempt to keep abreast of "classic" knowledge and developments in time-constrained environments; this is shown by 29% of our top 100 articles being included in "selected readings." Strong links need to be maintained between surgeons and psychiatrists, in particular, given the importance of such articles and journals contained in this list.

The most-cited article by Burget and Menick¹² from 1985 discussed reconstruction of the nose based on topographic areas of its anatomy designated as subunits, cen-

Table 2. The List of the 100 Most-cited Articles in Rhinoplasty

Rank	Study	No. of Citations	Rank	Study	No. of Citations
1	Burget and Menick ¹	273	51	Koren et al ⁵¹	77
2	Sheen ²	272	52	Deva et al ⁵²	77
3	Robinson et al ³	242	53	Rees et al ⁵³	75
4	McCoomb ⁴	148	54	Rohrich et al ⁵⁴	74
5	Sarwer et al ⁵	142	55	Godin et al ⁵⁵	74
6	Bridger ⁶	134	56	Wells et al ⁵⁶	74
7	Erol ⁷	133	57	Rohrich and Adams ⁵⁷	73
8	Gunter and Friedman ⁸	127	58	Gunter and Rohrich ⁵⁸	72
9	Constantian and Clardy ⁹	126	59	Guyuron et al ⁵⁹	71
10	Kridel et al ¹⁰	124	60	Pribaz et al ⁶⁰	71
11	Toriumi et al ¹¹	118	61	Jackson and Koch ⁶¹	71
12	Salyer ¹²	118	62	Goin and Rees ⁶²	71
13	Tebbetts ¹³	116	63	Gunter and Rohrich ⁶³	71
14	Kumagai et al ¹⁴	116	64	Hinderer ⁶⁴	71
15	Menick ¹⁵	113	65	Garciaelasco and Mondragon ⁶⁵	70
16	Ching et al ¹⁶	112	66	Janeke and Wright ⁶⁶	70
17	Tajima and Maruyama ¹⁷	110	67	Grymer ⁶⁷	69
18	Toriumi ¹⁸	104	68	Owsley and Taylor ⁶⁸	69
19	Sarwer et al ¹⁹	103	69	Shumrick and Smith ⁶⁹	69
20	Honigman et al ²⁰	99	70	Alsarraf ⁷⁰	68
21	Klassen et al ²¹	99	71	Kasperbauer and Kern ⁷¹	68
22	Daniel and Calvert ²²	98	72	Courtiss and Goldwyn ⁷²	68
23	Gunter and Rohrich ²³	98	73	Herbert ⁷³	68
24	Sheen ²⁴	98	74	Millard ⁷⁴	68
25	Hay ²⁵	97	75	Rohrich et al ⁷⁵	68
26	Rieger ²⁶	96	76	Paniello ⁷⁶	67
27	Wellisz ²⁷	95	77	Phillips ⁷⁷	67
28	Millard ²⁸	93	78	Guyuron and Behmand ⁷⁸	66
29	Burget and Menick ²⁹	91	79	Veale et al ⁷⁹	66
30	Sheen ³⁰	89	80	Lovice et al ⁸⁰	66
31	Freeman et al ³¹	88	81	Rohrich and Hollier ⁸¹	66
32	Rankin et al ³²	88	82	Kimmelman ⁸²	66
33	Byrd and Hobar ³³	88	83	McGregor and Soutar ⁸³	66
34	Daniel ³⁴	88	84	Hay and Heather ⁸⁴	66
35	Moss et al ³⁵	88	85	Kridel et al ⁸⁵	65
36	Gunter et al ³⁶	87	86	Wang et al ⁸⁶	65
37	Crerand et al ³⁷	86	87	McComb ⁸⁷	65
38	Byrd et al ³⁸	86	88	Wright and Wright ⁸⁸	65
39	Farkas et al ³⁹	86	89	Rohrich et al ⁸⁹	64
40	Washio ⁴⁰	86	90	Park ⁹⁰	64
41	Byrd et al ⁴¹	85	91	Jacobson and Kasworm ⁹¹	64
42	Khouri et al ⁴²	84	92	Connolly and Gipson ⁹²	64
43	Peck ⁴³	84	93	McComb ⁹³	64
44	Millard ⁴⁴	84	94	Wardinsky et al ⁹⁴	63
45	Tessier ⁴⁵	81	95	Burget ⁹⁵	63
46	Constantian ⁴⁶	80	96	Daniel ⁹⁶	61
47	Ortizmonasterio et al ⁴⁷	79	97	Mulliken and Martinez-Perez ⁹⁷	61
48	Alsarraf et al ⁴⁸	78	98	Sclafani et al ⁹⁸	61
49	Maull et al ⁴⁹	78	99	Hammer and Prein ⁹⁹	61
50	Weikel and Habal ⁵⁰	78	100	Guerrerosantos ¹⁰⁰	61

For references see Appendix I in the **Supplemental Digital Content 1**, which displays the references for Table 2; a list of the top 100 articles in “rhinoplasty,” <http://links.lww.com/PRSGO/A234>.

Table 3. Countries of Origin for the 100 Most-cited Articles in Rhinoplasty

Rank	Countries	Count
1	United States	72
2	United Kingdom	8
3	Australia	6
4	Canada	3
5	Mexico	2
5	Japan	2
6	Spain	1
6	Switzerland	1
6	France	1
6	Denmark	1
6	Israel	1
6	Scotland	1
6	Turkey	1

tral in perceived aesthetic outcomes, and in planning surgery.¹² The second most-cited article by Sheen¹⁴ from 1984 detailed the use of a spreader graft in reconstruction of the roof of the middle nasal vault after rhinoplasty, which is important for its use as an effective technique with good aesthetic and functional outcomes in one of the most commonly requested areas of primary or secondary rhinoplasty.

Goin and Rees¹⁵ conducted a prospective study that demonstrated several important findings regarding patients’ postoperative psychological reactions to rhinoplasty, quantified by the Brief Symptom Inventory. This was pivotal in documentation on the influence between surgery and psychology with discrepancies between clinician

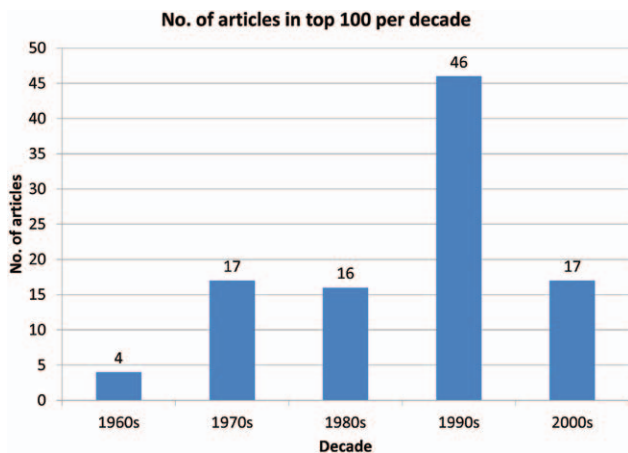


Fig. 2. The number of the hundred most-cited articles in rhinoplasty by decade.

and patient appraisal of aesthetic outcomes and expectations. The cosmetic procedure screening questionnaire created by the team at the Department of Psychiatry and Behavioural Sciences at University College London¹⁶ was valuable in identifying patients with body dysmorphic disorder who may have a poor prognosis with cosmetic rhinoplasty. Recent work by this team has resulted in the production of a national cosmetic screening tool for body dysmorphic disorder used in the United Kingdom.¹⁷ There may be a lag time between new concepts becoming available and their acceptance internationally with later citations; 2 examples might include the trend from closed to open rhinoplasty¹⁸ and the utilization of the cosmetic procedure screening tool.¹⁶

Sarwer et al¹⁹ undertook a review on the psychology of cosmetic surgery, and their article highlights the

necessity for a “psychological work-up” before surgery and describes cosmetic surgery as a psychological intervention for self-esteem and other factors. Understanding body image concerns of cosmetic surgery patients has become incorporated into daily practice to limit the potential for unwanted psychological trauma from such procedures. Their review highlighted the need for further rigorous progress in psychological theory and research particularly into preoperative assessment and postoperative response to the resulting change in appearance.¹⁹ The review by Honigman et al²⁰ further elaborated on this point and attempted to identify predictable factors for screening patients who would not be satisfied with the outcomes of cosmetic surgery. These factors included being young, a man, having unrealistic expectations, previous unsatisfactory surgery, minimal deformity, motivation based on relationship influence, and a history of depression, anxiety, or personality disorder.²⁰

Other important articles in the list include retroauricular-temporal flap described by Washio²¹ and total osteotomy of the middle face described by Tessier²² which have been picked out due to their technical wizardry alongside the forehead paramedian flap²³ which is an example of a workhorse technique, both of which are important in a plastic surgeon’s skill set.

A problem encountered in all surgical specialities and not simply those relevant to rhinoplasty is the lack of randomized controlled trials and generally, articles with OECBM levels 1 and 2. Unfortunately, despite a strong push for higher-quality studies in recent years, funding is still limited and not all surgical procedures can be investigated through randomized controlled trials. This is likely due to limited incidence in conditions, variation in presentation (especially true for plastic surgery), and difficulty in standardizing the patients, facilities, equipment, and surgeons.²⁴

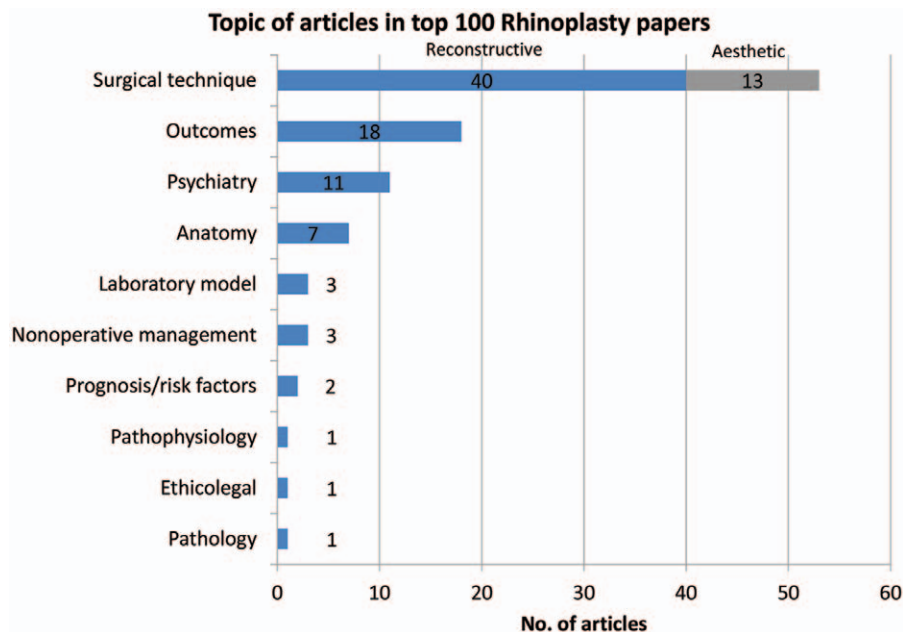


Fig. 3. Focus of top 100 rhinoplasty articles; surgical technique was subdivided into those that focused on reconstructive operations and those techniques used for aesthetic purposes.

Table 4. Number of Articles with Their Respective OCEBM Level of Evidence

Level of Evidence	No. of Articles
1	0
2	0
3	24
4	64
5	12

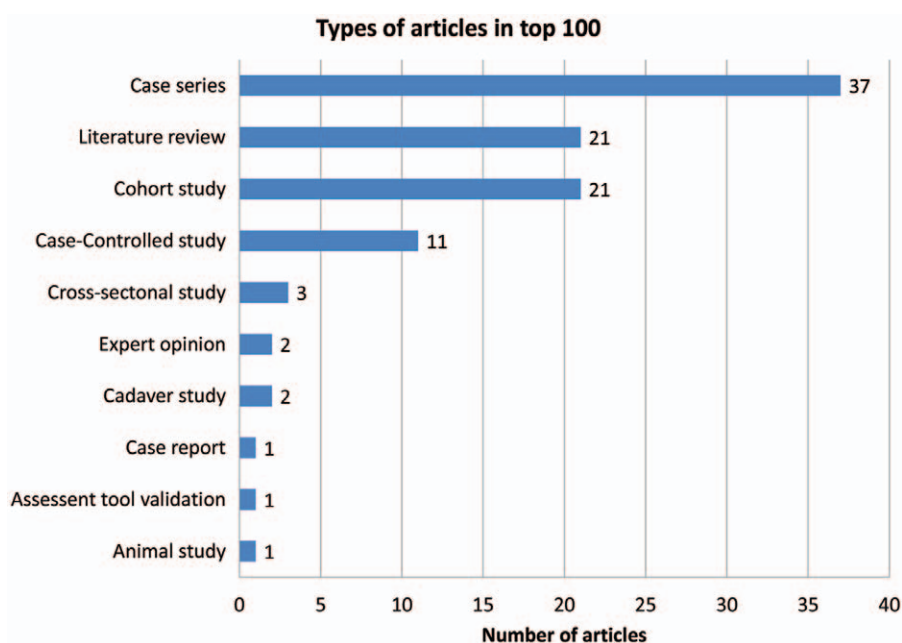
More than half the articles were techniques and follow the classic pattern of demonstration of a new technique with only the use of excellent illustrated examples. However, for the modern day plastic surgeon and patient, outcome assessment in a validated objective manner is needed and was not present in 79 of the 100 top articles. There is a lack of internationally validated outcome measures for aesthetic rhinoplasty.²⁵ Therefore, the challenge for future academic surgeons is not to copy these articles but to authenticate their techniques and methods with clear, objective outcome measures.

The common features of our top 100 articles include nonfunded research that is of clinical relevance, study designs involving case-series or cohorts (eg, level 3 or 4), being published in a high IF journal, is work from a single center, and focuses on reconstructive surgical techniques. Some of these findings are interestingly contrary to principals of EBM and to factors thought to result in a high-quality article. However, as demonstrated in the study designs within our list, measurement of scientific quality is not correlated with citations; therefore, once an article has crossed a threshold in terms of quality, it is eligible to be highly cited as long as it has significant clinical relevance.

The profile of topics demonstrates that there is a heavy focus on surgical techniques (n = 53) but also in outcome

measurement (n = 18), psychiatry (n = 11), and anatomy (n = 7). The choice of subjects reflects the interests of the authors, journal, and the scientific community. These high-impact articles have had an influence in rhinoplasty as they inform surgeons' and clinicians' day-to-day practice and disseminating new concepts that are of direct clinical relevance and are thus integrated into clinical practice. One of the strengths in our methods is that we covered all journals in the Science Citation Index database, including those not traditionally considered as high-impact plastic surgery journals, for example, important psychiatry journals; this has been a shortfall of previous similar studies.^{7,9,26} Loonen et al⁹ undertook a bibliometric analysis of the most-cited articles in plastic surgery as a whole, and their results demonstrate similar distributions to those of rhinoplasty regarding the journals (PRs), countries, and institutions (those affiliated to the United States), most common topic of article (reconstructive surgical techniques), low OCEBM levels employed (100% levels 4 and 5 in all of plastic surgery vs 24% level 3 and 76% levels 4 and 5 in rhinoplasty), the speciality, and preference of single-center studies (66% in all of plastic surgery vs 75% in rhinoplasty).⁹ Although the articles themselves are different, the areas of interest and features of a high-cited article in plastic surgery are consistent and therefore reproducible.

Publications per decade as shown in Figure 2 demonstrate that a vast number of the most-cited articles were published in the 1990s (n = 46), but following this the 2000s also continued to produce highly cited articles (n = 17) and previous decades had fewer citations than the 1990s. The distribution of articles by decades showed that older articles were not heavily favored because of effects of citation accumulation with time. This can possibly be explained by the concept of "obliteration by inclusion"

**Fig. 4.** The types of articles employed in the hundred most-cited rhinoplasty articles.

described by Garfield in 1987²⁷ (as the knowledge contained within an article becomes more accepted and incorporated into the scientific community, the less it is referenced and considered as acceptable common knowledge).

Although we have used the methodology previously described by Kyler et al,⁷ one of the issues with citation analysis is that our list is naturally a dynamic one and to incorporate this facet, there are other methods besides the absolute number of citations for measuring the contribution of articles.²⁶ A reasonable alternative is the citations index (total citations over a period of years/number of years).⁹ It is generally considered that it can take 10 to 15 years for an article to reach its citation index peak^{7,8}; therefore, this method was not employed as it would exclude several of the most-cited articles, especially those from recent years.

Having contributed so heavily to the growth of this area of surgery, the United States had the largest number of authors and institutions. This is not entirely surprising given the country's more accepted attitudes toward aesthetic rhinoplasty by their population, high gross domestic product, large scientific community, high demand, access to health-care, and promotion of a culture of academia within medicine and surgery. However, there may be some attributable bias to this success; orientated bias may play a role in the form of autociting (authors try and increase the apparent recognition of their articles by citing themselves), local bias (authors in the United States cite other authors they know in the United States), and in-house bias (authors cite colleagues and mentors). Further forms of negative orientated bias take the form of omission and incomplete biases; these refer to authors incorrectly not giving credit and citations to appropriate authors for the influence of their published work.²⁸ The journals themselves may promote bias toward promoting American work as they can exhibit powerful person bias (authors cite reviewers or editors of journals in an attempt to increase the chances of acceptance of their article), a national bias (reviewers for American journals can be biased toward accepting articles published from American authors),²⁹ and English language bias (journals are more likely to accept articles written in English).²⁸ Despite these limitations, a vast number of journals were searched and the articles listed have made a significant contribution to this field of surgery and given the large number of citations should be entitled as being considered "classics" in rhinoplasty.

CONCLUSIONS

Citation analysis is not a measure of scientific quality and is afflicted by biases; however, it is an objective measure and we have used it to determine the most highly-cited articles in rhinoplasty. These top 100 articles have shaped current practice, are used in current teaching material, and enforce surgical decision-making. We document the extensive use of cohorts and case-series as well as the evaluation of results primarily with photographs. Much has been achieved through the use of lower OECBM methods; however, an evolving era of plastic surgery and an increasingly litigation-conscious climate demand stringent methodology and systematically repeatable results. The current challenges for academic rhi-

noplasty lie in the incorporation of validated objective outcome measures into the methodology and outcome analysis. These measures will not only benefit surgeons but also patients and the greater scientific community in developing techniques with the most favorable results.

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