RESEARCH

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Development of Rhinoplasty: Yesterday and Today

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Objective: **The purpose of this study is to analyse the development of rhinoplasty studies between 1980 and 2017 through bibliometric analyses.** ***Background:*** **Rhinoplasty is one of the major operations in plastic surgery, it is popular, and the number of operations has been increasing every day. However, the literature has only one study which investigated the development of rhinoplasty. Therefore, the present study on rhinoplasty is believed to shed light to plastic surgery studies.** ***Methods:*** **Bibliometric analyses were performed by retrieving all the publications in Web of Science (Clarivate Analytics' WoS) database between 1980 and 2017 using the 'Rhinoplasty' keyword.** ***Results:*** **The number of publications found using the "Rhinoplasty" keyword was 2977. Of all these publications, 2261 (75.9%) were articles. The highest number of publications was in the year 2016 with 237 publications (10.5%). With 911 publications (40.3%), the USA was the most productive country. The top two active authors who produced most publications about rhinoplasty were Rohrich R.J. (64-2.8%) and Guyuron B. (45-1.2%). The journals which made the greatest contribution to the literature were Plastic and Reconstructive Surgery with 426 publications (18.8%) and Aesthetic Plastic Surgery with 314 publications (13.9%).** ***Conclusion:*** **The number of studies on rhinoplasty has been increasing every day. Result of this first comprehensive bibliometric study showed that the USA was the most active country and it was followed by Turkey, which indicates the contribution of the developing countries to rhinoplasty.**

INTRODUCTION

Rhinoplasty, which is one of the fundamental operations of plastic aesthetic and reconstructive surgery, has been getting more and more attraction every day, and its prevalence has been increasing. In line with this, there has been a notable acceleration in the literature as well. The present study aims to identify the development of rhinoplasty publications by using bibliometric analyses and indicating the most active authors, countries, and top-cited articles during 1980-2017. It also aims to highlight the trend topics in rhinoplasty.

Nose is one of the most important formations of the face. Rhinoplasty operations should involve the use of both functional and aesthetic parameters together. It is important to protect nose functions, namely eliminating respiratory problems, while reshaping the nose structure. Rhinoplasty operations are performed in patients with congenital anomalies, traumatic nasal deformities, deformities in nose wall, or for changing the aesthetic appearance of the patient.

Bibliometrics is the statistical analysis of publications such as books and articles published in the literature [1]. Citation analysis in bibliometrics is one of the most important indicators of the value of an article in its field [2]. Bibliometric analyses enable to identify the most active authors, journals, countries and the international collaborations between them [3-4]. In this study we aimed to analyse the development of rhinoplasty studies between 1980 and 2017 by using bibliometric methods.

MATERIAL AND METHODS

Documents needed for descriptive statistics and bibliometric analyses were obtained from Web of Science (Clarivate Analytics' WoS), (access date: 06.01.2018). Search was performed using the "rhinoplasty" keyword (*Topic: "Rhinoplasty"*). Studies published in the field of surgery between the years 1980 and 2017 were involved in the study. As a result of the analyses, 2261 out of 2977 publications which were articles were analyzed only. GunnMap free resource (http://lert.co.nz/map/) was utilized for the world map. VOSviewer (Version 1.6.6) package programming was used for Bibliometric Network Visualizations [5]. We carried out this research in accordance with the ethical standards of the Helsinki Declaration of 1975, as revised in 1983.

RESULTS

The search performed with the "rhinoplasty" keyword revealed 2977 publications. H-index of these publications were 60, average number of citations per year was 10.68, and the total number of citations was 24157 (without self citations: 12860). Of the 2977 publications, 2261 (75.95%) were articles, 267 (8.97%) were proceedings papers, 248 (8.33%) were letters, 214 (7.19%) were editorial materials, 83 (2.79%) were reviews, 26 (0.87%) were notes, and 57 (1.89%) were other publications (Discussion, Correction, Meeting Abstract, Retracted publication). Bibliometric analyses were performed with only 2261 articles in the field of surgery. Almost all of the articles were English (2204; 97.5%). Other languages were French (50; 2.2%), German (6; 0.27%) and Spanish (1, 0.04%) respectively.

Distribution of the publications according to years is demonstrated in Fig.1. Especially after the year 2010, with more than 100 articles, there has been a notable increase in rhinoplasty publications (see Fig.1). Distribution of the citations of these publications according to years is presented in Fig.2. More than 500 citations were received in the year 2002, and with more than 1000 citations, the year 2009 and later showed an increase in the number of citations (Fig.2).

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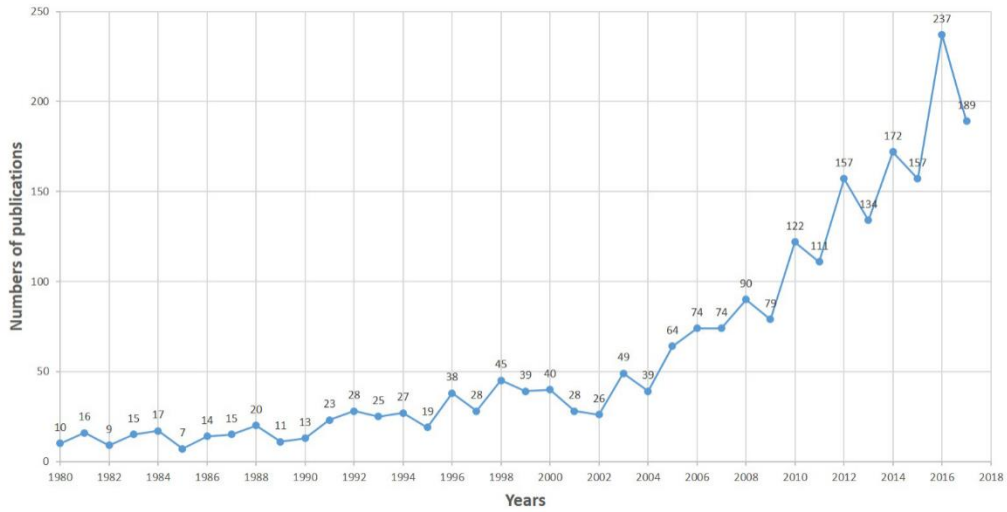

Figure 1 Numbers of publications according to years on Rhinoplasty

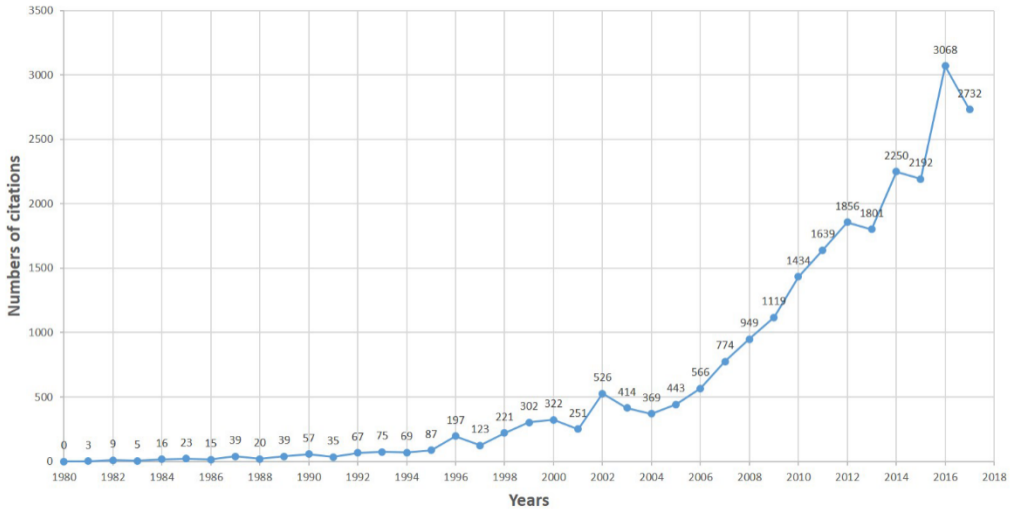

Figure 2 Numbers of citations according to years on Rhinoplasty

Active Countries

Publication distributions according to countries were transferred to the world map and is demonstrated in Fig.3. Colors that become more intense from yellow to red show the countries that made more contributions to the literature. With 911 (40.29%) publications, the USA was the country that made the most contribution to the literature about rhinoplasty. Then the top ten countries that made the most contribution were Turkey: 307 (13.58%), South Korea: 197 (8.7%), Italy: 94 (4.16%), Canada: 90 (3.98%), England: 87 (3.85%), Germany 86 (3.80%), Iran 66 (2.91%), France 65(2.87%), Brazil: 49 (2.17%) and Peoples R China 43(1.90%) respectively. Collaborations between the countries are demonstrated in Fig.4. Clusters among the countries are seen more clearly in Fig.5. USA, Turkey, Iran, and Chile were in the same cluster; France, Hungary, Italy, Spain, Thailand and Australia were in the same cluster; and England, Ireland, Netherlands, Scotland and Switzerland were in one cluster. Other collaborations are demonstrated in Fig.4 and Fig.5.

Active Authors

Table 1 demonstrates the top 10 active authors who produced the highest number of articles about rhinoplasty. An analysis of Table 1 shows that the top 3 authors were Rohrich RJ (64-2.83%), Guyuron (45-1.99%) and Daniel RK (43-1.90 %).

Citation Analysis

Table 2 demonstrates the top cited 10 publications about rhinoplasty. According to the total number of citations, the most effective publication was the study entitled "Spreader graft: a method of reconstructing the roof of the middle nasal vault following rhinoplasty" published in Plastic and Reconstructive Surgery Journal in 1984 [6]. This publication received 330 citations in total and average 9.43 citations per year. The second top-cited study was the article entitled "The Turkish delight: a pliable graft for rhinoplasty", which was published in Plastic and Reconstructive Surgery journal in 2000 [7]. The study received 184 citations in total and average 9.68 citations per year. The study entitled "New Concepts in Nasal Tip Contouring" [8], which was ranked fifth

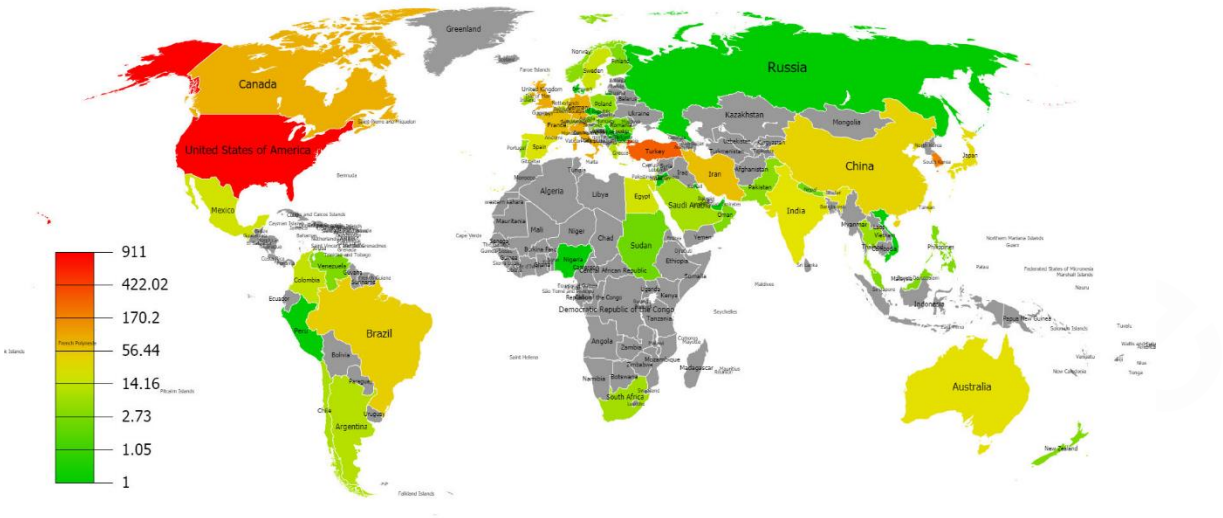

Figure 3 World map of Countries publishing on Rhinoplasty

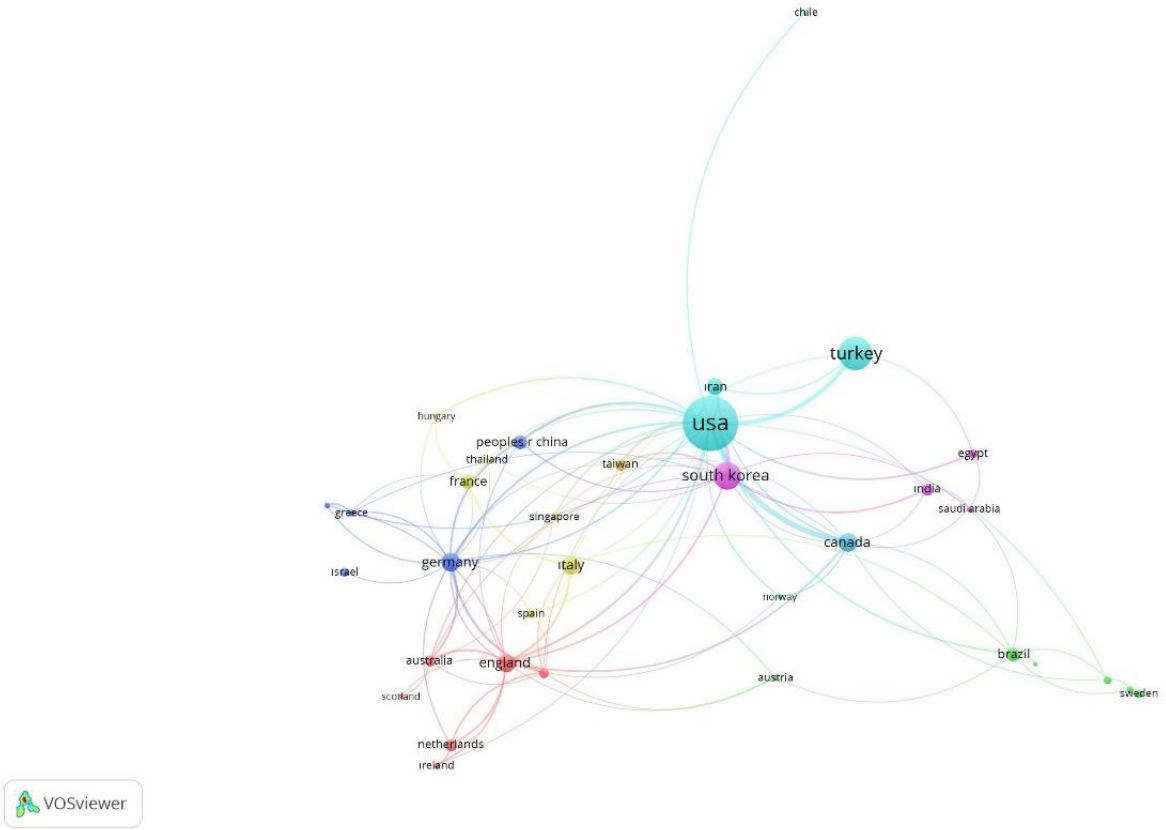

Figure 4 Network visualization map of international collaboration analysis
Footnote: *Circle size shows the number of publications, colours cluster, and lines show collaborations.*

Table 1 The first 10 authors by record count on rhinoplasty

Authors	Record Count	%
Rohrich RJ	64	2.83
Guyuron B	45	1.99
Daniel RK	43	1.90
Gruber RP	32	1.41
Jang YJ	31	1.37
Constantian MB	20	0.88

Kim JH	20	0.88
Most SP	19	0.84
Toriumı DM	19	0.84
Gunter JP	18	0.80

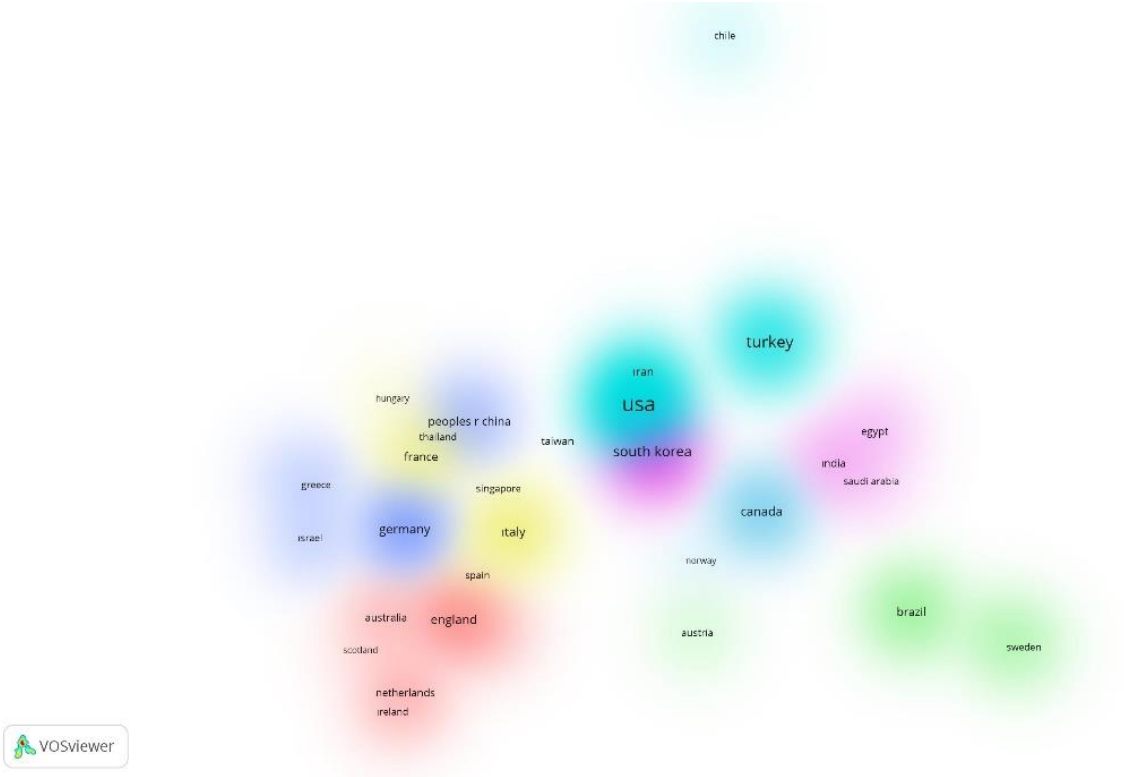

Figure 5 Network visualization map of cluster analysis of active countries
Footnote: *colours shows the cluster*

Table 2 The 10 most cited manuscripts on rhinoplasty

No	Article	Author	Journal Name/Published	Total Citation	Average Citations per Year
1	Spreader graft: a method of reconstructing the roof of the middle nasal vault following rhinoplasty	Sheen JH.	Plastic and Reconstructive Surgery-1984	330	9.43
2	The Turkish delight: a pliable graft for rhinoplasty	Erol OO.	Plastic and Reconstructive Surgery-2000	184	9.68
3	The relative importance of septal and nasal valvular surgery in correcting airway obstruction in primary and secondary rhinoplasty	Constantian MB. Clardy RB.	Plastic and Reconstructive Surgery-1996	152	6.61
4	Lateral crural strut graft: technique and clinical applications in rhinoplasty	Gunter JP. Friedman RM.	Plastic and Reconstructive Surgery-1997	151	6.86
5	New concepts in nasal tip contouring	Toriumi DM.	Facial Plast Surg-2006	143	11.0
6	Diced cartilage grafts in rhinoplasty surgery	Daniel RK. Calvert JW.	Plastic and Reconstructive Surgery-2004	142	9.42
7	Use of alar batten grafts for correction of nasal valve collapse	Toriumi DM. Josen J. Weinberger M. et al.	Arch Otolaryngol Head Neck Surg-1997	139	6.32
8	A Review of Psychosocial Outcomes for Patients Seeking Cosmetic Surger	Honigman RJ. Phillips KA. Castle DJ.	Plastic and Reconstructive Surgery-2004	135	9.00
9	Shaping and positioning the	Tebbetts JB.	Plastic and	128	5.12

	nasal tip without structural disruption: a new, systematic approach		Reconstructive Surgery-1994		
10	Psychological investigations in cosmetic surgery: a look back and a look ahead	Sarwer DB. Pertschuk MJ. Wadden TA. et al.	Plastic and Reconstructive Surgery-1998	118	5.62

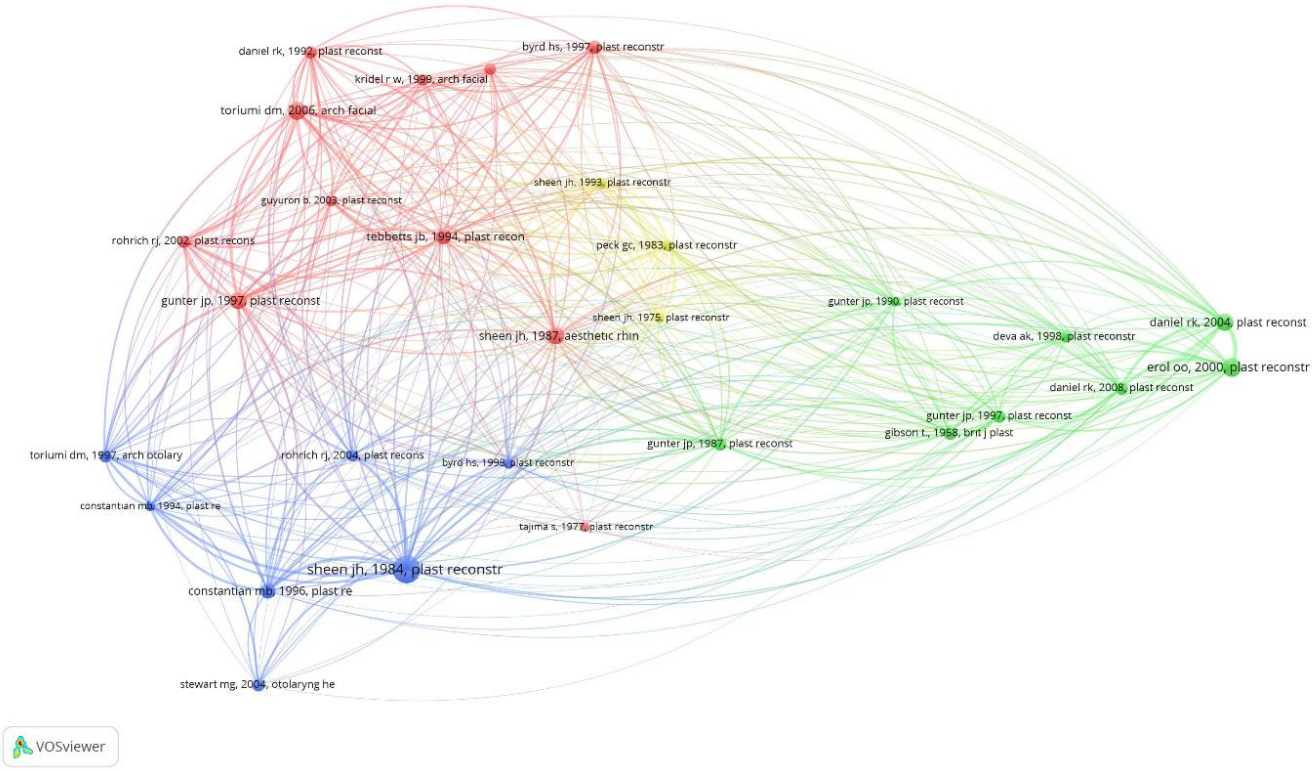

Figure 6 Network visualization map of co-citation analysis of active authors in cited references

Table 3 The first 10 journal source by publications on rhinoplasty

Journal Name	Number of publications	%	Citations
Plastic and Reconstructive Surgery	426	18.84	10257
Aesthetic Plastic Surgery	314	13.89	2307
Journal of Craniofacial Surgery	215	9.51	853
Facial Plastic Surgery	187	8.27	608
Annals of Plastic Surgery	153	6.77	1887
Archives of Facial Plastic Surgery	112	4.95	1795
Aesthetic Surgery Journal	105	4.64	621
Jama Facial Plastic Surgery	84	3.71	357
Journal of Plastic Reconstructive and Aesthetic Surgery	72	3.18	647
Clinics in Plastic Surgery	68	3.01	657

Table 4 The first 68 trend keywords onrhinoplasty

Keyword	Number of occurrences	Keyword	Number of occurrences	Keyword	Number of occurrences
rhinoplasty	628	alar cartilage	19	cleft palate	13
nose	80	augmentation rhinoplasty	19	forehead flap	13
septoplasty	49	nasal valve	19	nasal surgery	13
nasal tip	45	plastic surgery	19	quality of life	13
nasal reconstruction	42	anthropometry	17	complications	12
revision rhinoplasty	38	asian	17	cleft lip nose	11
spreader graft	37	complication	17	extracorporeal septoplasty	11
cleft lip	34	functional rhinoplasty	17	implant	11
open rhinoplasty	34	nasal dorsum	17	internal nasal	11

				valve	
septorhinoplasty	33	revision	17	lateral crus	11
costal cartilage	26	asian rhinoplasty	15	primary rhinoplasty	11
nasal obstruction	26	cleft lip and palate	15	septal extension graft	11
secondary rhinoplasty	26	cosmetic surgery	15	septum	11
crooked nose	24	dorsal augmentation	15	tip	11
osteotomy	24	ecchymosis	15	upper lateral cartilage	11
saddle nose	23	edema	15	aesthetic	10
cartilage graft	22	rhınoplasty	15	body dysmorphic disorder	10
diced cartilage	21	spreader grafts	15	bone graft	10
nasal deformity	21	aesthetic surgery	14	cartilage grafts	10
nasal septum	21	cleft rhinoplasty	14	septal cartilage	10
augmentation	20	deviated nose	14	septal deviation	10
cartilage	20	reconstruction	14	tip projection	10
graft	20	short nose	14		

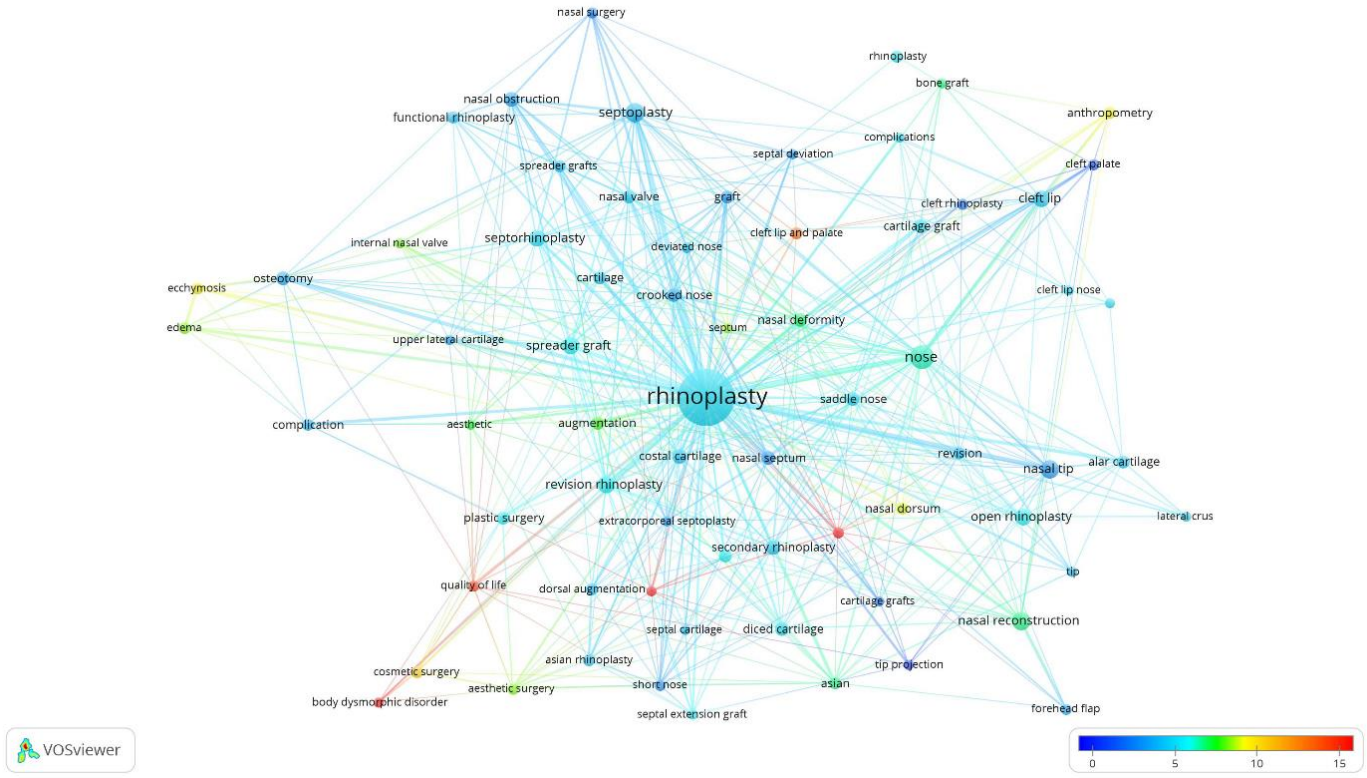

Figure 7 Network visualization map of relationships between the most commonly used keywords in the abstract.
Footnote: *Colours that become more intense from blue to red show the multitude of citations the article has received*

and published in Arch Facial Plast Surg journal in 2006 was the top-cited study according to the number of citations per year. This study received 143 citations in total and average 11.0 citations per year.

Co-citation Analysis

Co-citation map of the top-cited 29 documents among 19054 publications which were in the references section of the 2261 publications is demonstrated in Fig.6. According to co-citation analysis, the most important top-cited two studies were the studies written by Sheen JH. in 1984 and by Erol OO. in 2000 and published in Plastic and Reconstructive Surgery journal.

Active Journals

Table 3 demonstrates the top 10 journals which made the highest contribution to the literature about rhinoplasty. The top 5 journals that made the highest contribution to the literature were Plastic and reconstructive surgery (426-18.84%), Aesthetic Plastic Surgery (314-18.89%), Journal of Cranio facial Surgery (215-9.51%), Facial Plastic Surgery (187-8.27%), and Annals of Plastic Surgery (153-6.77%)

respectively. The top 5 journals according to the number of citations were Plastic and reconstructive surgery (10257 citations), Aesthetic Plastic Surgery (2307 citations), Annals of Plastic Surgery (1887 citations), Archives of Facial Plastic Surgery (1795 citations), and Journal of Craniofacial Surgery (853 citations).

Trend Topics

Table 4 demonstrates the most popular 68 keywords which were used at least 10 times among the 2603 keywords used in 2261 publications. Bibliometric relationship analyses are presented in Fig.7. An analysis of Fig.7 shows that the top-cited trend keywords are shown in red (cleft lip and palate, reconstruction, implant, quality of life, body dysmorphic disorder).

DISCUSSION

Due to the increased number of publications, bibliometric analyses have gained importance. Moreover, these kinds of publications guide researchers. In line with the increased popularity of rhinoplasty, there has been a notable increase in the number of publications and citations within the last decade. Bibliometric analyses showed that Plastic and Reconstructive Surgery and Aesthetic Plastic Surgery were the journal which had the highest number publications in the field of rhinoplasty. Given that the top-cited publications were published in this article, Plastic and Reconstructive Surgery was the most active and effective journal, which was followed by Aesthetic Plastic Surgery and Journal of Craniofacial Surgery.

USA made the most contribution to the rhinoplasty literature. On the other hand, Turkey, which was ranked second in the contribution to the literature, had 307 publications; and South Korea had 197 publications. While according to the number of publications there were three developed countries (Turkey, Iran and Brazil) at top 10, top 20 includes 7 developing countries (Turkey, Iran, Brazil, China, Taiwan, India, Egypt) including Turkey. Therefore, significant contribution of the developing countries as much as some developing countries could be mentioned.

According to document citation numbers and co-citation analysis, although Rohrich RJ., was the author who had the highest number of publications in the field of rhinoplasty, the most effective publication was the study entitled "Spreader graft: a method of reconstructing the roof of the middle nasal vault following rhinoplasty" and published in Plastic and Reconstructive Surgery written by Sheen JH in 1984. In addition, the study entitled "New Concepts in Nasal Tip Contouring" published in Arch Facial Plast Surg in 2006 by Toriumi DM was found to be the best article according to average number of citations per year.

Review of the literature indicated that another bibliometric study was conducted by Sinha et. al. (2016) with the title "A Bibliometric Analysis of the 100 Most-cited Articles in Rhinoplasty" in Plast Reconstr Surg Glob Open [9]; the superiority of the present study is that bibliometric analyses are supported by visual maps, particularly key word analyses in order to identify the trend topics. In addition, although in Sinha Y's study the top-cited article was "The subunit principle in nasal reconstruction" written by Burget GC. And Menick FJ, our review results showed that this study was not indexed in Web of Science. In addition, in recent years a study by Lalezari et al. "Trends in Rhinoplasty Research: A 20-Year Bibliometric Analysis" was published in Aesthetic Plastic Surgery [10].

Keyword analysis showed that spreader graft, which was used 52 times, was used as "spreader graft" for 37 times and as "spreader grafts" for 15 times. Its usage in rhinoplasty was found to increase. In addition, "Cleft lip" and "cleft palate", the fundamental issues of plastic surgery, were found to be the top-cited keywords, which indicates that rhinoplasty was also frequently used for reconstructive surgery.

The present study has only one limitation. Web of Science database provides no access to the publications before 1980 [11, 12]. In addition, our study did not include databases out of WoS such as PubMed and Scopus, because WoS database is known to be the most reliable database in publications and citations. Only journals with high impact factor are indexed in WoS database [13].

CONCLUSION

Given the increasing number of publications in literature, the present bibliometric study on rhinoplasty is believed to enlighten researchers focusing on this issue and provide faster and compact information in a shorter time. The present study, which is the most comprehensive bibliometric study on this issue, has demonstrated the bibliometric profile of rhinoplasty by analyzing the active authors, countries, trend topics, and citations in the articles published between 1980 and 2017. Turkey was the second most effective country after the USA, which is important in terms of showing the contribution of the developing countries to rhinoplasty.

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Compliance with Ethical Standards

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Conflict of Interest

Authors Musluand Demir declares that he has no conflict of interest.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

This article does not contain any studies with human participants or animals performed by any of the authors.

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