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Qualitative Terms Used In Rhinoplasty: A Scoping Review — Toward Establishing a Bridge Between Qualitative Terminology and Quantifiability

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Abstract

Background Rhinoplasty is one of the most commonly performed aesthetic surgical procedures. Both patients and surgeons rely on qualitative descriptors such as "plunging nose," "bulbous tip," or "twisted nose" to describe nasal features. Despite their frequent use, there is limited standardization of these terms and their correlation with objective measurements.

Methods A scoping review was conducted following the PRISMA-ScR guidelines. The study searched three electronic databases (PubMed/MEDLINE, Ovid/MEDLINE, and Web of Science) for English language articles published between 1949 and 2021. Qualitative descriptors and semi-quantitative and quantitative measures were extracted and categorized.

Results A total of 459 studies were included, comprising retrospective studies (272), prospective studies (38), technical descriptive articles and literature reviews (180), and letters to the editor (5). Qualitative terms were recorded 23.5% (237/1007) of the time, semi-quantitative terms 16% (162/1007), and quantitative descriptions 57% (578/1007). The most commonly described nasal features were the tip (20.8%), dorsum (13.2%), and alar base (12.3%). Measurement techniques varied, with photography being the most common (60%), followed by surgeon assessment (20.3%) and 3D imaging (5.4%).

Conclusions This review highlights a gap in the correlation between qualitative rhinoplasty descriptors and quantitative analysis. Standardization and integration of objective measurement tools may enhance clinical communication and surgical planning.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Rhinoplasty · Nasal analysis · Qualitative description · Quantitative measurements · Scoping review

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Introduction

Rhinoplasty is performed to alter the shape of the nose and is one of the most common facial plastic surgeries performed. When patients describe their goals for rhinoplasty, they most often use qualitative expression, such as "I have a plunging nose." Rhinoplasty surgeons also use similar qualitative descriptions when describing the nose preoperatively, designing a surgical plan and defining the postoperative findings [1, 2].

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Surgeons also use varied qualitative descriptions for similar deformities, such as "crooked nose" and "twisted nose," both of which are used to describe a deviation from the facial midline. A "bulbous" or "wide tip" may both be used to describe a tip deformity with broad lower lateral cartilages that have an increased dome angle and/or increased interdomal distance, and so on [3]. General or specific measurements and descriptives of these qualitative aspects are not fully defined [4].

Quantitative descriptions that are based on certain facial landmarks and measurements may be varied as well; however, these descriptions tend to be more universally applied. Examples of quantitative descriptions include the nasolabial angle based on tip–subnasale–upper lip [5]. Patients and surgeons tend to communicate using more qualitative and layperson terms, which may limit the emphasis on evaluating quantitative descriptions [1]. As an eminent surgeon has said, "most surgeons rely on their experience, their right brain, and the patient's wishes instead of an analysis of measurements" [2].

Over the last decade, a cognitive revolution in medicine has taken place and that most probably will completely transform surgery [6]. Enhanced visualization, data analytics, and machine learning are components of this revolution and are likely to become more integral in rhinoplasty. As data acquisition and objective measurements of the alterations made by rhinoplasty are available, we believe that a compilation and description of the qualitative terms used in rhinoplasty should be created to help build a base for data-oriented rhinoplasty science. As such, one would be able to distinguish differences between noses, i.e., a bulbous tip from a triangular tip, with numeric data once the bridge from qualitative terms to quantitative data form is established.

In this study, we seek to define what terms have been used in rhinoplasty research for qualitative descriptions of nasal deformities and determine whether they are correlated with quantitative descriptions. In doing so, we examined most of the descriptive terms used in English rhinoplasty literature that exist internationally, find correlative qualitative and quantitative term use for these terms, and categorize these terms to help build a base for data-oriented, practical objectivity to rhinoplasty science. A scoping review was performed to map the literature available to help construct a bridge between qualitative evaluations and quantitative analyses. This may ultimately be used to help develop software for rhinoplasty analysis with norms and standard deviations according to this information gathered from existing literature.

Methods

This study is a review of previously published literature and does not contain any interaction with or information from specific human participants or animals performed by any of the authors. For this type of study, informed consent is not required.

A scoping review was planned according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement extension for Scoping Reviews (PRISMA-ScR) [7, 8].

Our protocol was developed using the scoping review methodological framework proposed by Arksey and O'Malley (2005) [9] and the updated methodological guidance for the conduct by Peters et al. [8] The protocol was registered *a priori* at the website of Open Science Framework (OSF) [10]. Further details related to the review techniques applied throughout this study can be found in the Supplemental Table 1 (whole study data).

Once the search terms used in medical publications were established, comprehensive literature searches of electronic bibliographic databases were conducted in PubMed/MEDLINE, Ovid/MEDLINE, and Web of Science, comprising the years of 1949 to 2021. Published medical literature was searched. Inclusion and exclusion criteria can be seen at Supplemental Table 2. The search was kept within the domain of English language. The search strategy, the title and abstract screening tool, and the pre-defined charting form are given in Supplemental Table 3.

During the review, all terms used in the articles to describe either the entire nose or a part of the nose were recorded. The terms were listed as categories such as qualitative, semi-quantitative, and quantitative (angles, distances, etc.), and the related parts of the nose, such as tip, dorsum, and entire nose, were listed as well. The semi-quantitative terms, such as over-projection or wide alar base, were further described with the range of the terms and, if present, the reference points of the spectrum. An example of this is Johnson and Codin's four-stage rating system for tension deformity (Class 0 = no tension deformity, Classes 1–3 = light, moderate, and severe deformities, respectively).

Once the scoping search was completed to identify key words and relevant studies, the members on the research team were educated about for the study selection and data extraction, who subsequently evaluated the studies and documented qualitative and quantitative descriptions and relevant data in a spreadsheet. The results were collated and summarized.

Table 1 Ranges with the most common occurrences according to the main groups

Group	Subgroup	Ranges	Occurrences	% of All Ranges
Skin	Nasal skin	Thick/heavy	80	3,885381253
Tip projection	Nasal tip projection	Inadequate	50	2,428363283
Tip projection	Nasal tip projection	Adequate	46	2,23409422
Tip projection	Nasal tip projection	Overprojected	45	2,185526955
Skin	Nasal skin	Thin	44	2,136959689
Nasolabial angle	Nasolabial angle	Acute/narrow	41	1,991257892
Alar base	Nasal base	Wide/broad	38	1,845556095
Tip projection	Nasal tip projection	Underprojected	35	1,699854298
Radix	Radix	Low	30	1,45701797
Columella	Columellar show	Inadequate	28	1,359883439
Hump	Dorsal/nasal hump	Large	25	1,214181642
Tip rotation	Tip rotation	Overrotated	24	1,165614376
Dorsum	Dorsum/dorsal profile	Low	20	0,971345313
Nasal length	Nasal length	Short	20	0,971345313
Nasofrontal angle	Nasofrontal angle	Obtuse	18	0,874210782
Dorsum	Dorsum/dorsal profile	Broad/wide	17	0,825643516
Nasal length	Nasal length	Long or excessive	17	0,825643516
Alae	Lateral crura	Vertically-oriented	17	0,825643516
Nasolabial angle	Nasolabial angle	Obtuse/large/wide	16	0,777076251
Nasolabial angle	Nasolabial angle	Ideal/optimal	15	0,728508985

Results

A flow diagram outlining the article selection process and number of studies yielded at each step is provided in Fig. 1.

In total, 7799 studies were identified from three databases. After removal of the duplicates, 3435 studies were screened. From these studies, based on the titles and abstracts, 2971 were excluded and 464 studies were chosen for a full-text evaluation. Thirty-one studies were excluded for the following reasons: out of focus (n=14), no useful material (n=2), duplicates (n=6), cannot retrieve (n=7), and retracted (n=2). As we were able to add 26 more studies retrieved from other sources, namely organizations, subsequently, 459 papers were included and were used for data extraction. Full citations are listed in alphabetical order in Supplemental Table 4.

Study Characteristics

A total of 459 articles were included. Of these, 272 were retrospective studies, as case reports, case series, or cohort studies. There were 38 prospective studies. There were 180 technical descriptive articles and literature reviews. Five letters to the editor or correspondences were included (Fig. 2).

The articles were disseminated between 1970 and 2021, with 70% published after 2010. Most were conducted on Asian population (n=192, 37%) and Anglo-European population (n=124, 24 %).

One hundred twenty-four articles did not have any population specified. The distributions can be found in Fig. 3.

Types of Terms

Qualitative terms and general descriptions of the nose or its parts, such as “snub nose,” “bulbous tip,” or “dorsal hump,” were noted 237 (23.5%) times out of 1007 various descriptions given in total. Semi-quantitative terms that describe the nose with a non-measured parameter such as narrow vs. wide tip and acute vs. obtuse nasolabial angle were noted 162 (16%) times. Quantitative terms that were most often described in two-dimensional measurements, such as distances (or length), angles, or ratios, were noted 578 times (57%). There were very few studies with volume measurements which were noted only 3 times. (0.3 Articles also described “position” of the nose (n=27, 2.68%).) Examples include tip position, alar base position, position of the ala, upper lip position, etc. Ranges for these tended to be descriptions such as “normal/abnormal position” and “high/low position” (Fig. 4).

Methods Used to Evaluate the Nose

Photography was the most common method (364/604, or 60%) to be followed by the surgeon’s evaluation (123/604 or 20.3%). 3D imaging was used in 33 (5.4%) articles. Direct measurement was used in 27 (4.5%) articles. No

Table 2 Sample of quantitative descriptions and ranges discussed in sthe study according to the subgroups with the most common occurrences

Subgroup	Ranges	Method	Description	References
Alae	Wide	Measured from the ala curvature point to the pronasale	The ala length in a set of above-average faces averaged 31.0 +/- 1.8 mm. It was found that the ala is wide-based in non-Caucasian noses compared to Caucasian noses. The ala length surf averaged 35.9 +/- 2.2 mm	Farkas; Kolar; Munro (1986)
Alae	Wide	Comparison of interalar and intercanthal distances	Wide alar is indicated when the interalar distance exceeds the intercanthal distance	Kim; Park; Jang (2016)
Alae	Wide	Comparison with intercanthal distance	A satisfying alar width is 31-33mm wide, but it generally should not be wider than the intercanthal distance in Caucasians. Thus, a width greater than 33mm indicates wide alae	Zhong; Zhu; Jiang; Yuan; Xu; Cao; Yu; Wei (2021)
Boxy nose	Type I	Examination of the intercrural angle of divergence and domal arc	If the intercrural angle of divergence is greater than 30 degrees, but the domal arc is normal (equal to or less than 4 mm wide), then some authors in the literature classify this as a Type I boxy nose	Özkan; Mete (2019)
Boxy nose	Type II	Examination of the intercrural angle of divergence and domal arc	If the intercrural angle of divergence is normal (less than 30 degrees), but the domal arch is widened, then some authors in the literature classify this as a Type II boxy nose	Özkan; Mete (2019)
Columella	Narrow	Measurement between two subnasale points	The columella width averaged 6.6 +/- 0.6 mm in a set of above-average faces, though the Germanic subgroup tended to have the narrowest (and longest) columella. Narrower columellas were associated with attractive faces	Farkas; Kolar; Munro (1986)
Intercanthal distance	Narrow	Comparison with the interalar distance	In Asians, the intercanthal distance is narrower than the interalar distance	Gandolfi; Laloze; Chaput; Auquit-Auckbur; Grolleau; Bertheuil; Carloni (2020)
Long axis of nostrils	Slightly narrow	No method?	The long axis of the nostrils should be nearly parallel with the vertical axis of the columella, with the anterior position slightly narrower than the posterior position	Ponsky; Guyuron (2010)
Nasal tip	Broad/ wide	Removal of cephalad portion of LLC	Removal of the cephalad portion of the LLC resulted in a reduction of projection and a wider tip	Guyuron (1991)
Nasal tip	Broad/ wide	Malposition of lateral crura	The authors state that malposition of the lateral crura can present as broad tip	Göksel; Vladykina (2017)
Nasal tip	Broad/ wide	No method?	A wide nasal tip may be characteristic of Mestizo noses	Cobo (2014)
Nasal tip	Bulbous	Malposition of lateral crura	The authors state that malposition of the lateral crura can present as bulbous nasal tip	Göksel; Vladykina (2017)
Nasal tip	Bulbous	Examination of distance between tip-defining points	Normally, the distance between tip-defining points is 5-6 mm. With distances greater than 6 mm, bulbous tip is indicated	Tai-ling; Zhi-qiang; Da-shan; Hai-ming; Xiao-jun; Jia-qi; Xin; Jia-lin; Ji-guang (2009)
Nasal tip	Boxy	Examination of the nasal base and angularity between middle crus	Some authors have described the boxy nasal tip as a square-shaped nasal base with a sharp angulation at the lateral genu, related with a wide angularity between middle crus as much as 90 degrees	Özkan; Mete (2019)
Nasolabial angle	Ideal/ optimal	No method?	The ideal nasolabial angle is 105-115 degrees in females and 90-105 degrees in males	Steiger; Baker (2009)
Nasolabial angle	Ideal/ optimal	No method?	The optimal nasolabial angle is considered to be 90-105 degrees in men and 105-120 degrees in women	Fagundes; Moreira; Tambara; Tenório; Fraga; Hamerschmidt (2016)
Nasolabial angle	Ideal/ optimal	Measurement between columella and upper lip	The angle between the columella and upper lip should be between 90 and 110 degrees in a normal nose, though women belong to the upper part of this range	Stoksted; Gutierrez (1981)

Table 2 continued

Subgroup	Ranges	Method	Description	References
Nasolabial angle	Ideal/ optimal	No method?	The ideal nasolabial angle has been reported as 95-105 degrees in women and 90-95 degrees in men	Bucher; Kunz; Deggeller; Holzmann; Soyka (2020)
Nasolabial angle	Ideal/ optimal	References to literature; classical measurements	The nasolabial angle has been quoted to range from 90-120 degrees. It has been classically defined as 95-100 degrees in men and 103-108 degrees in women	Sinno; Markarian; Ibrahim; Lin (2014)
Tip rotation	Overrotated	Measurement of angles between the columellar and nasal tip vectors	Average cephalic rotation is given at 50 degrees, whereas obtuse cephalic rotation happens beyond that point. The vectors are measured at their intersection at the columella–lobe junction	Castro-Govea; Salazar-Lozano; Vázquez-Costilla; Moreno; Pérez; Vázquez (2014)
Tip rotation	Overrotated	No method?	The mean overrotation angle in the study was found to be 119 degrees preoperatively	Pedroza; Pedroza; Achiques; Felipe; Becerra (2014)
Tip rotation	Underrotated	No method?	The mean underrotation angle in the study was found to be 87 degrees preoperatively	Pedroza; Pedroza; Achiques; Felipe; Becerra (2014)
Tip rotation	Underrotated	No method?	Underrotated tip is characteristic of the Latino nose, though no quantitative values are given	Perez; Mohan; Rohrich (2019)
Tip rotation	Ideal/ desirable/ proper	No method?	Desirable tip rotation is between 100-110 degrees in women and 90-100 degrees in men	Demir (2018)
Tip rotation	Ideal/ desirable/ proper	No method?	A nasal tip rotation of 0-15 degrees in males and 15-30 degrees in females is ideal	Giacomini; Rubino; Mocella; Pascali; Di Girolamo (2017)

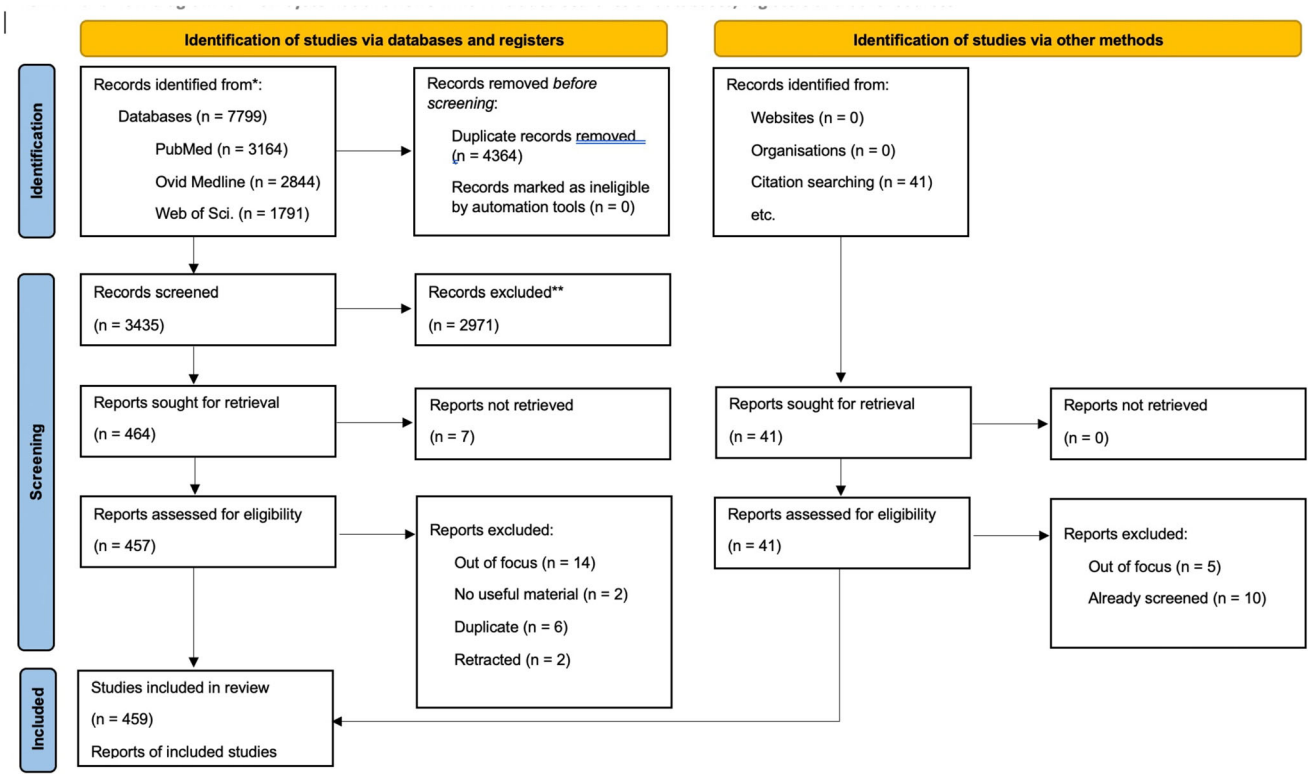

Fig. 1 PRISMA diagram

method was specified in 18 (3%) articles. We also identified a few articles with mentions of software being used such as MATLAB or some morphing techniques to help evaluate the nose (Fig. 5).

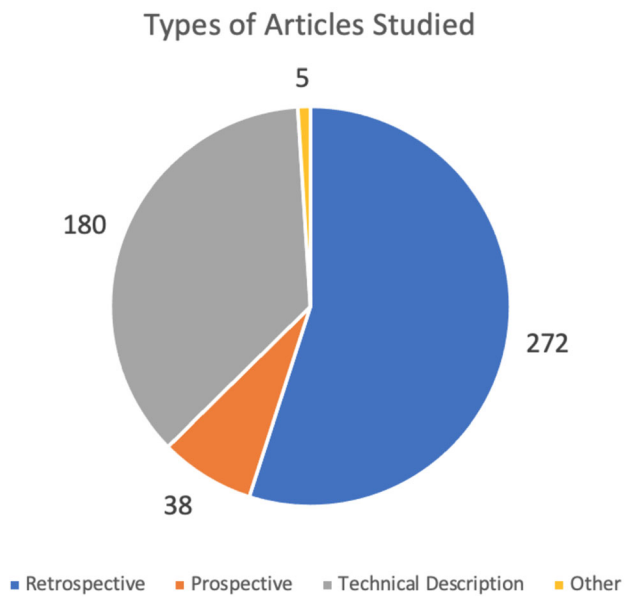

Fig. 2 Types of articles studied

Related Parts of the Nose

The tip region was described most (303 out of 1457 instances or 20.8%) followed by dorsum (192/1457 or 13.2%), alar region (180/1457 or 12.3%), and columella (169/1457 or 11.6%). Nostril described in 111 (7.6%) and radix in 73 (5.0%) instances. A total of 203 (13.9%) descriptions were about the nose in general; the items included in this group were axis, midline, and skin as shown in Fig. 6.

Types of Measurements

Out of 696 measurement types found, most measurements involved angles (n=189, 27.1%), to be followed by distances (n=178, 25.6%) and ratios (n=123, 17.7%). There were qualitative evaluations (n=171, 24.5%), and there were non-numeric measurements in semi-quantitative fashion (n=5, 0.7%). S-shaped deviation, C-shaped deviation, and over-rotated nose are examples to semi-quantitative evaluations. Some articles (n=27, 3.9%) used position and orientation as the evaluation techniques, e.g., position of the nasal tip. Position refers to the location of certain elements of the nose, usually relative to the position of other aspects of the nose. For example, one article defines the short nose in terms of where the columella

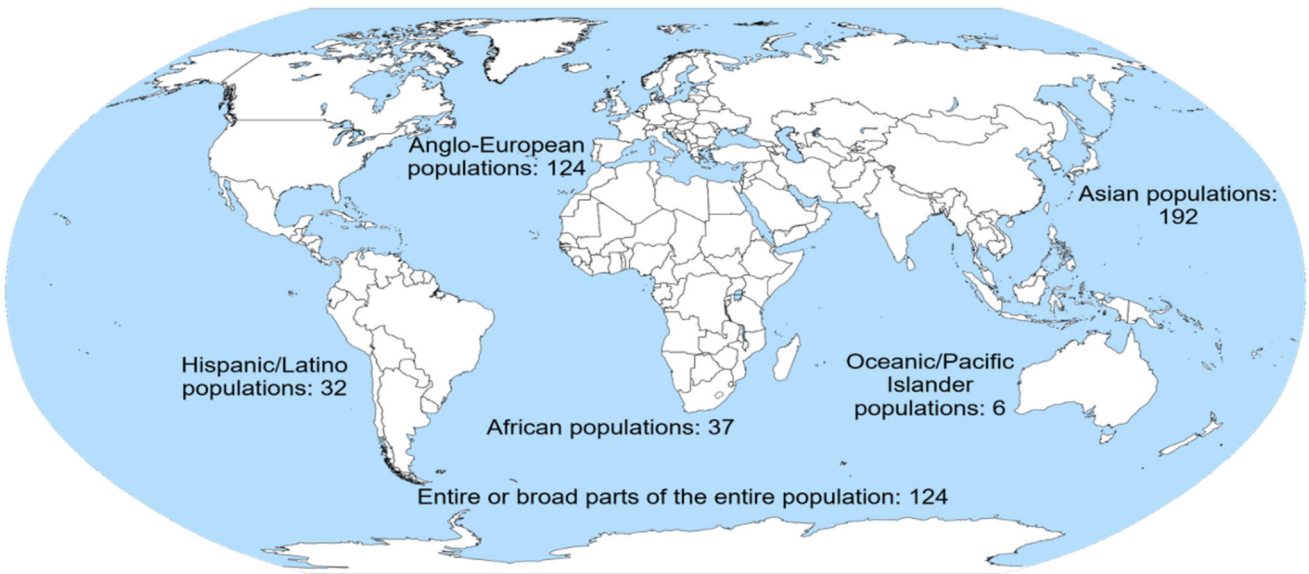

Fig. 3 Geographic population distribution according to the origin of the study. Groups were arranged as below: Entire world: General Population, Broad, Trans-gender, Aging, Nonwhite, White, Non-Caucasian, Caucasian, Western. Asian: Middle East, Iran, Pakistan, Korea, Turkey, Iran, India, China, Saudi Arabia, Israel, Malaysia, Japan. Anglo/European: Roman, Italy, USA, Greece, UK, Germany, Canada, North America, Europe, Bulgaria, France, Netherlands, Denmark, Switzerland, Macedonia. Black/African: Africa, Egypt. Hispanic/Latino: Mexican, Latino, Mestizo, Hispanic, Colombia, Brazil, Chile, Central America, South America, Caribbean, Argentina. Oceanic/Pacific Islander: Australia, Hawaii, New Zealand

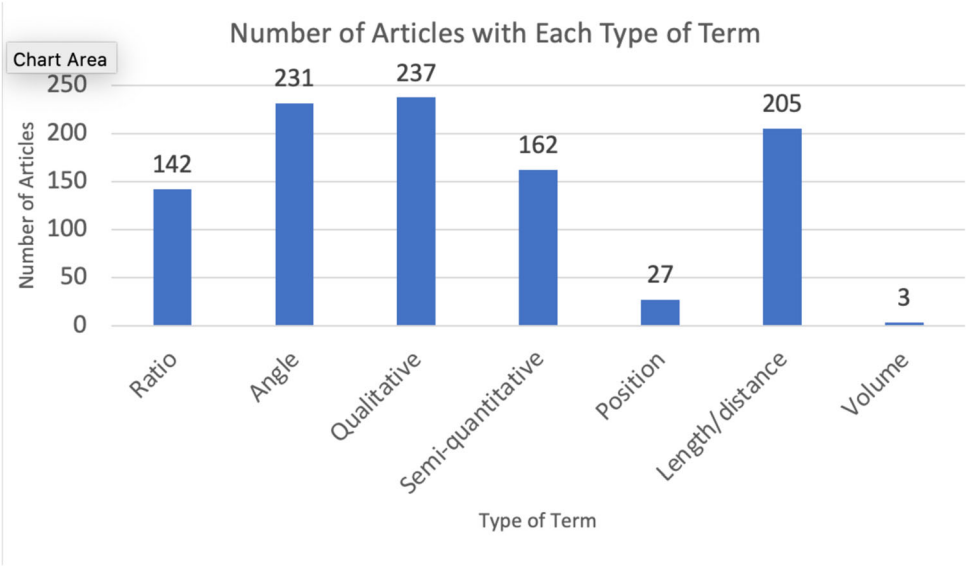

Fig. 4 Number of articles with each type of term

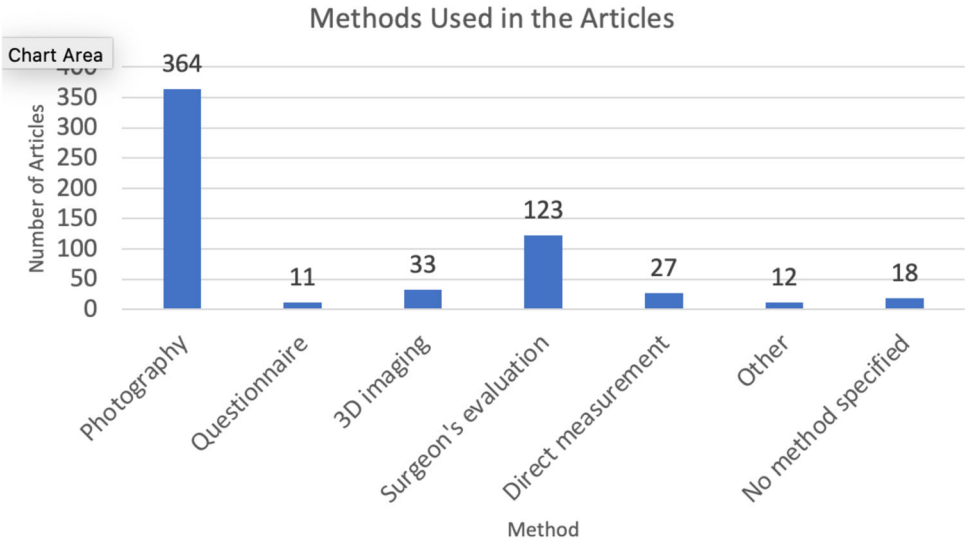

Fig. 5 Methods used to evaluate the nose

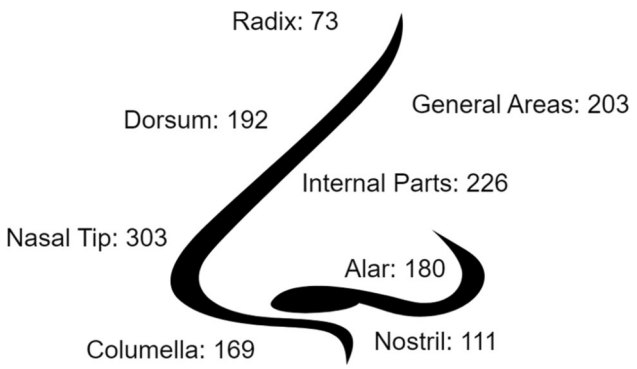

Fig. 6 The distribution of the related parts of the nose that were found in the studies

points are located relative to the lowest points of the alar base (Supra Alar Island Flap and Costal Cartilage for Arrow Tail Short Nose Deformity Correction (Liu, Wei, Li 2020). Volume measurements were found in only 3 (0.04%) articles (Fig. 7).

Settings

Most of the terms were found from preoperative evaluations (n=257), to be followed by postoperative evaluations (n=241). The terms used for the description of the nose were identified as pre- or postoperative in 176 articles. The distributions can be found in Fig. 8.

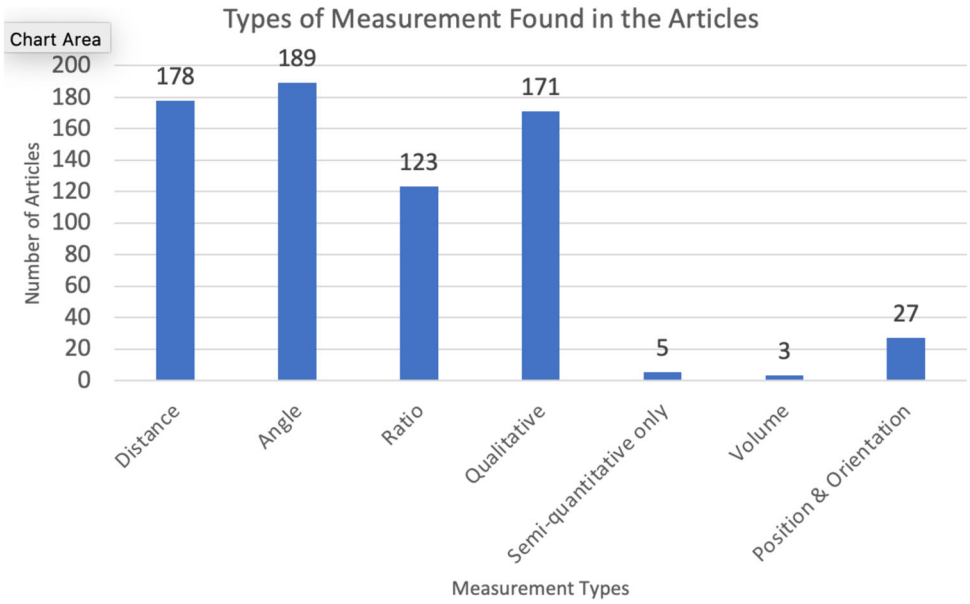

Fig. 7 Types of measurements found among the articles

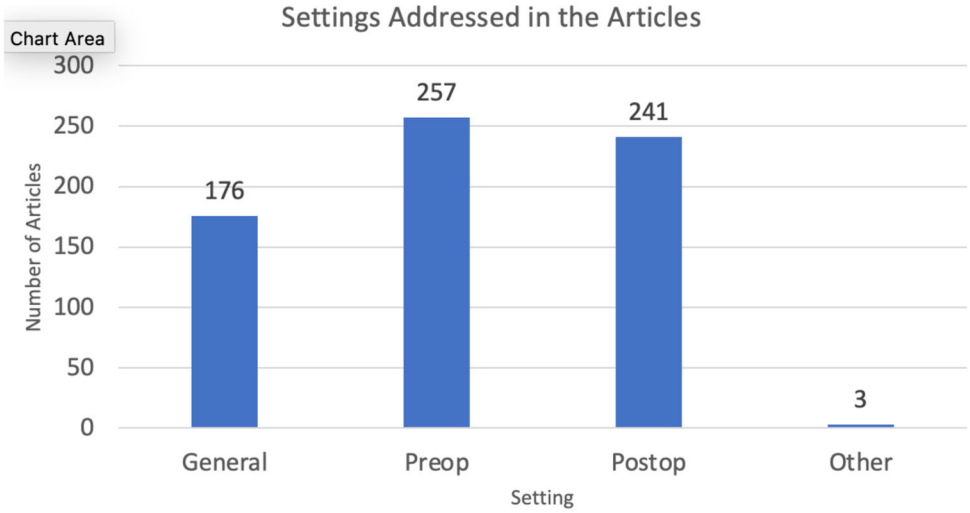

Fig. 8 Settings where the evaluations for rhinoplasty were done

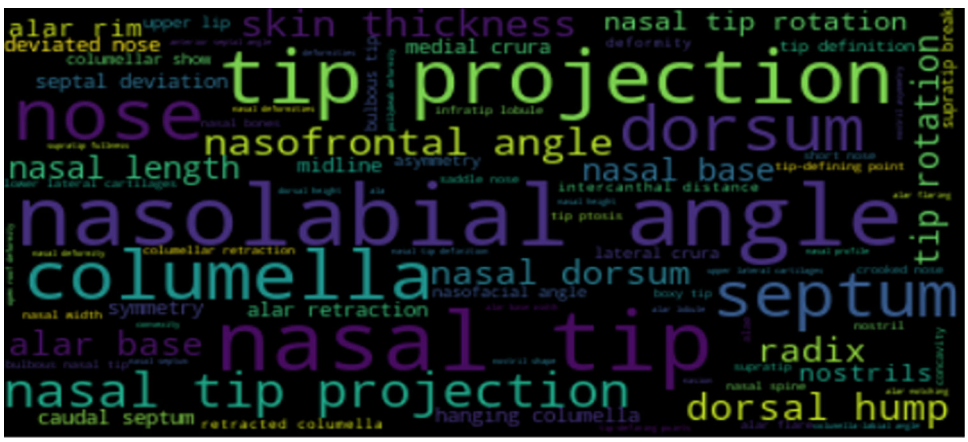

Fig. 9 A wordle chart to help visualize the commonalities of certain terms

Terms Used

A wordle figure can be found in Fig. 9 used to help see the commonalities of the terms used and their relative distributions. The numeric values of the frequency of encountering these terms can be found in the Supplemental Table 1 (whole study data). We had counted 2059 occurrences in total. According to these counts, the top ten most encountered terms were "tip projection/nasal tip projection" with 197 occurrences, "skin/nasal skin" with 128 occurrences, "dorsum/dorsal profile" with 95 occurrences, "nasolabial angle" with 82 occurrences, "tip/nasal tip" with 75 occurrences, "nose" with 67 occurrences, "lateral crura" with 52 occurrences, "alar base/nasal base" with 52 occurrences, "tip rotation" with 52 occurrences, and "nostrils" with 51 occurrences.

Ranges

Some qualitative terms were associated with further descriptions, such as narrow, wide, bulbous, humpy, pointy, boxy, and trapezoid. Some quantitative terms were associated with ranges, e.g., 95^0 to 110^0 for nasolabial angle. Other times, authors would discern that the nasolabial angle is obtuse or acute or normal. We found 2059 occurrences of such descriptions, and among them 25.6% of ranges were with at least one quantitative description. The 20 most common ranges seen according to the main groups and subgroups in the articles can be found in Tables 1 and 2, respectively.

Landmarks

The landmarks used for the evaluation of a nose that were noted in the article were studied. The total number of landmarks was 1927. The landmark that was most commonly used was the nasal tip (n=220, 11.4%), to be followed by the alae (n=203, 10.5%). No landmark was given in 154 (8%) articles. The results are given in Fig. 10.

Discussion

This study seeks to evaluate the literature for qualitative descriptions in rhinoplasty and correlate these terms with quantitative descriptions. The changes made by a rhinoplasty are apparent and often times easily described by patients in lay terms. Physicians often use simplified and only slightly more technical terms, such as pollybeak deformity, boxy tip, pseudo-hump, and projectile nose. These terms tend to be descriptive and subjective, qualitative with some semi-quantitative descriptions such as narrow tip, over-rotated tip, and low radix.

We performed a scoping review of the medical literature, to determine whether there are equations that correlate with the qualitative definitions used for rhinoplasty evaluation. We seek to help construct a bridge between qualitative descriptions and quantitative measurements used for rhinoplasty analysis.

The results indicate that 57% of the articles included in this study had, to some extent, used some qualitative evaluations. Quantitative evaluations were used in almost a quarter (23%) of the articles. Semi-quantitative evaluations were used within 16% of them. This finding is a reflection of the evaluation systematic used by surgeons in general.

The methods used to evaluate a nose were 2D photography in 60% of the articles, whereas 3D imaging was used in only 5.4% of them. The second most used evaluation technique was the surgeon's own evaluation, used 20% of the time. Rhinoplasty surgeons have been using their own evaluations since the introduction of the technique, preoperatively, during the surgery and postoperatively [11]. As one of the most common aesthetic procedures all around the world, it is not our purpose to criticize this

Fig. 10 Landmarks that were used for the evaluation of the nose

approach. However, with the accumulation of data-driven knowledge, we believe rhinoplasty will benefit significantly from a more data-oriented rhinoplasty evaluation, i.e., quantitative measurements.

There have been examples of recent studies utilizing a machine learning algorithm to objectively quantify the anti-aging effect of rhinoplasty [12]. It is likely that more studies will continue to incorporate newer technologies to help achieve the goal of evaluating outcomes objectivity. At this point, most researchers will utilize traditional anthropometric techniques for this [5, 13].

Our results indicate that among the studies that had quantitative analyses, most were depending on such anthropometric evaluations, either from a photograph or via direct measurements. Even though we found out that 57% of the articles had, to some extent, some quantitative measurements, much of that analysis was relying on 2D images. A systematic review does point out to a similar finding that very few studies utilize quantitative measurements and among them very few methods were used [14].

A study utilized MATLAB software to evaluate the nasal base views obtained from 2D photographs to trace the contour of each nasal base. The nasal bases were categorized according to pre-defined shapes (equilateral, boxy, cloverleaf, flat, round, and narrow) via

visual inspection, another sample of semi-quantitative or rather descriptive approaches. The software then performed a curve fit to the parametric model with output of values for 5 parameters: projection-to-width ratio, the anterior–posterior positioning of the tip bulk, symmetry, degree of lateral recurvature of the nasal base, and size [11].

As scanning techniques were developed, further studies were published in an effort to incorporate the newer techniques into the clinical practice [15–19]. The advantage of these techniques is the data acquisition which enables data analysis. We believe it is to the clinicians to help further develop the data analysis for rhinoplasty utilizing the 3D imaging techniques and software. Although it is conceptual yet, it can be assumed that the area and volume measurements and the semi-quantitative figure descriptions, such as crooked nose or plunging tip or flat nose, might find their quantitative counterparts in the near future.

Some studies did use comparisons with CT radiology, which is not a component of common practice [20, 21].As this review is focused on surface features which are used in rhinoplasty practice, no radiological feature was included into the search. Similarly, nasal passage evaluation from a functional perspective was not included into the search as well.

The majority of descriptions in this review were qualitative. On occasion, there were semi-quantitative descriptions complementing them. Among the 2059 occurrences of such descriptions, we found 25.6% were accompanied with at least one quantitative description. Therefore, the majority of descriptions are qualitative alone and do not have a quantitative counterpart.

An example from a commonly used parameter in rhinoplasty would be related to the tip's position. From a side view, nasal tip might be seen as over-rotated, under-rotated, or in proper position. These positions seem to have some equations used as well. For female patients, a nasolabial angle measuring within 95^0-110^0 would be accepted as a standard of beauty, whereas those measurements that would be out of these ranges would be evaluated as either under- or over-rotated accordingly [22, 23].

Nasolabial angle is a rather universally accepted parameter. However, once one starts to look for other measurements to help define a nose, it becomes obvious this is an area that needs more studies. What differs a wide nose and a narrow nose, a boxy tip and a bulbous tip, a tension nose and a flat nose? All of these and many more are well-known descriptions to rhinoplasty surgeons; however, a vast majority of them do not have a quantitative counterpart.

This study indicates that the current literature is mainly utilizing qualitative descriptions for nasal analysis in the rhinoplasty literature. As the number of nasal and facial measurements computed by software tools increases, the accuracy and precision of the analysis of the face will improve. When more facial measurements from this comprehensive and current list are utilized in these tools, they will provide a more in-depth and detailed evaluation of the nose and the face [5]. Not only will these tools be utilized for scientific studies, they will help guide surgical techniques with the newer technological tools. The opportunities for obtaining more objective measurements and data during rhinoplasty analysis should allow for more quantitative descriptions of the patient's deformities and results.

This study also shows that most of the articles used photography for nasal evaluation and descriptions, and 2D photography appears to continue to be the current common practice[24, 25].Increased utilization of 3D imaging will allow for accuracy in the near future [18, 26, 27]. Improvements in objective evaluation techniques utilizing 3D photography, including volumetric analysis which is currently only described in 0.3% of the studies, will allow for more accurate quantitative evaluation of nasal analysis and results [15, 28].

A limitation for this scoping review is that we can only determine qualitative and quantitative descriptions being used by surgeons that are in the published literature. It is possible that surgeons are using more quantitative and objective measurements for analysis in their practice that they are not describing in publications. Also, only publications in English were used for the study; this might have caused some limitations, even though most of the

retrievable literature is in English. Finally, no grey literature was sought; we decided to keep our sources within the published sources' realm.

Other limitations for identifying appropriate literature to review was the fact that we included only three databases, namely Pubmed/MEDLINE, Ovid/MEDLINE, and Web of Science; more database utilization could have broadened our findings. The keywords were used with an effort to include all parts of a nose as well as commonly used terms; we might have missed some terms. Finally, we had 459 full-text articles to review, which meant a significant time requirement on the team; despite that, we believe we managed to have completed the search effectively and all of the steps were well documented.

The results from this study clearly show a lack of correlation of qualitative descriptions that are frequently used in nasal analysis by both patients and surgeons, with associated quantitative descriptions. As we continue to develop improved techniques for obtaining and evaluating data, with 3D photography, measuring capabilities on imaging software and machine learning, we should encourage surgeons to provide more objective descriptions of the nose and correlate quantitative descriptions with qualitative terms.

Declarations

Conflict of Interests The authors declare that they have no conflicts of interest to disclose.

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

Informed Consent For this type of study informed consent is not required

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