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Nasal Index and Its Correlation with Rhinoplasty Outcomes: A Systematic Review and Meta-Analysis

Índice Nasal y su Correlación con los Resultados de la Rinoplastia: Una Revisión Sistemática y Metanálisis

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SUMMARY: Nasal morphology in patients with cleft lip plays a critical role in both aesthetic balance and functional integrity. Nasal index is a key anthropometric measurement determines surgical plan and outcome in cleft deformities. A systematic literature search was conducted using PRISMA guidelines. Studies assessing nasal dimensions in female cleft lip patients post-early primary rhinoplasty versus healthy controls using photogrammetric or 3D morphometric methods were included. Data were synthesized using RevMan 5.4.1, and pooled mean differences were calculated for nasal width, height, and index. Risk of bias was controlled using JBI appraisal tools. Two eligible studies (case *vs.* controls: n = 45 *vs.* 54; μ ± SD = 19.18 years old) were included in the quantitative synthesis. In the patients, the commonest diagnoses are consecutive non-syndromic patients with unilateral cleft lip nose deformity who underwent primary rhinoplasty. Meta-analysis showed that nasal width and height in the patients were greater than in controls (MD = 1.22 mm, 95 % CI: 0.26 to 2.18, p = 0.01, I^2 = 84 %; MD = 0.77 mm, 95 % CI: -0.49 to 2.04, p = 0.23 I^2 = 0 %, respectively). The nasal index revealed no statistically difference (MD = 0.92, 95 % CI: -2.50 to 4.34, p = 0.60, I^2 = 25 %). The limited number of studies restricts conclusive interpretation, though findings were consistent across sensitivity analyses.

KEY WORDS: Nasal index; Rhinoplasty; Cleft lip palate; Health outcomes.

INTRODUCTION

The nasal index (NI), a ratio of nasal width to nasal height multiplied by 100, is a crucial anthropometric parameter used to classify nasal morphology. It plays a fundamental role in rhinoplasty plan including in the cleft lip palate cases. This parameter can significantly affect both functional, surgical complexity and aesthetic balance. Nasal index is influenced by race, sex, and environmental factors e.g. temperature and nutrition. The classification of nasal type—leptorrhine, mesorrhine, or platyrrhine—based on nasal index, has clinical implication in identifying suitable surgical strategies for different patient profiles in these cases (Fazelzadeh *et al*., 2021; Seo *et al*., 2019; Seo *et al*., 2020a).

Three-dimensional imaging techniques including photogrammetric have revolutionized facial analysis by allowing for precise, reproducible, and non-invasive measurement of nasal parameters such as tip projection, alar width, and nasal angles. These tools provide surgeons with objective data to evaluate nasal deformities, plan individualized interventions, and assess outcomes post-rhinoplasty. The incorporation of quantitative morphometric analysis is especially valuable in populations with congenital deformities, such as cleft lip and palate, where nasal growth and proportional harmony are critical for long-term results (Fazelzadeh *et al*., 2021; Seo *et al*., 2019; Seo *et al*., 2020b).

In a three-dimensional photogrammetric study of patients with bilateral cleft lip and palate, Seo *et al*. (2019), found no significant differences in nasal height, surface area, or volume between individuals who underwent primary rhinoplasty in infancy, matched with healthy controls at skeletal maturity age. This finding supports

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the concept that primary rhinoplasty does not hinder nasal growth and, importantly, may even facilitate improved nasal symmetry and projection without compromising long-term development. These outcomes contrast the traditional view that early nasal surgery could interfere with growth, thus reinforcing the paradigm shift toward earlier intervention in cleft care. Seo *et al*. (2019); Seo *et al*. (2020a), also emphasized that post-operative nasal indices were significantly higher in cleft patients compared to controls, indicating that nasal index values may reflect surgical impact and residual deformities more than natural growth inhibition (Fazelzadeh *et al*., 2021; Seo *et al*., 2019; Seo *et al*., 2020a).

Despite such promising findings, a comprehensive synthesis of nasal index data and its relationship to surgical outcomes across various populations remains absent in the current literature. In this systematic review, we aim to evaluate whether the nasal index serves as a reliable predictor of the outcome and the satisfaction level in the cleft lip palate patients with post-early primary rhinoplasty. The nasal height, weight and index are then calculated in the meta-analysis to seek any significant differences between patients and controls. By consolidating evidence from multiple studies, the present analysis seeks to inform best practices in early primary rhinoplasty among cleft lip palate patients based on objective and non-invasive nasal measurements using 3D-photogrammetry.

MATERIAL AND METHOD

Search Strategy

This systematic review and meta-analysis were conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and registered in PROSPERO (PROSPERO 2024: CRD42024618652). A comprehensive literature search was performed to identify studies assessing the differences in nasal index measurement between the cleft lip palate patients with post-early primary rhinoplasty and healthy control females.

The search was conducted using multiple electronic databases, including Pub-Med, Scopus, ScienceDirect, MedLine and CNKI, to ensure broad coverage of relevant literature. The search was restricted to articles published within the last 10 years (2014–2024) and written in English. The following keywords and their combinations were used: "nasal width", "primary rhinoplasty", "cleft lip", and "nasal index”. Boolean operators (AND/OR) were applied to refine the search results.

Search Methods for Identification of Studies

The database search was supplemented by manual searches of reference lists from relevant articles to ensure all pertinent studies were included. All research papers and case reports that have been fully published were included. Pre-printed manuscripts, reviews, meta-analyses, editor letters, opinions and studies without intended variables were excluded. The search results were managed using reference management soft-ware to remove duplicate records before screening. Study selection followed the PRISMA flowchart to ensure a transparent and reproducible methodology (PRISMA, 2020).

Data Collection and Analysis

Study Selection. Titles and abstracts of all identified studies were initially screened to assess their relevance to the research question. Full-text articles were then retrieved for studies that appeared to meet the inclusion criteria or for which there was insufficient information in the abstract to make a clear decision. Two reviewers independently assessed the full-text articles for eligibility, ensuring that the selection process was rigorous and unbiased. Any disagreements between reviewers were resolved through consensus or, if necessary, by consulting a third reviewer.

Study Design and Population. The studies included in this review were observational in nature investigating nasal anthropometric characteristics and surgical outcomes associated with rhinoplasty in both cleft and non-cleft populations. Encompassing retrospective studies that reported nasal width, height and index in female patients undergoing rhinoplasty. The primary outcome of interest was the nasal width, height, and index, while secondary outcomes included overall patient satisfaction.

Inclusion Criteria. Studies were included if they met the following criteria: (1) The study population consisted of cleft lip palate patients with post-early primary rhinoplasty who underwent rhinoplasty; (2) Nasal width, nasal height and/or nasal index were reported in cleft lip palate with post-early primary rhinoplasty and healthy females; (3) The study was published within the last 10 years and written in English. Studies were excluded if they were review articles, case reports, or involved patients who underwent additional nasal procedures beyond rhinoplasty.

Data Extraction and Quality Assessment. Data from each included study were independently extracted by two reviewers using a standardized data extraction form. Extracted data included study characteristics such as author, year, study design, population size, and quality assessment scores (JBI score), along with patient demographics, including age and gender. Nasal parameters were recorded for both cleft lip patients and normal patients (Seo *et al*., 2019; Seo *et al*., 2020a). The quality of the included studies was evaluated using The Joanna Briggs Institute (2020) critical appraisal tools (Grandoch *et al*., 2023). Each study was categorized as low, moderate, or high quality based on its methodological rigor and potential risk of bias. Any discrepancies in data extraction or quality assessment were resolved through discussion or by involving a third reviewer to ensure accuracy and consistency in the analysis.

Statistical Evaluation. A meta-analysis was performed using Review Manager (RevMan Version 5.4.1) software (Copenhagen) to calculate the standardized mean difference (SMD) between female cleft lip and non-cleft lip patients in terms of nasal height, width and index measurements, with 95 % confidence intervals (CI) expected variability across studies, a random-effects model was applied to account for potential heterogeneity. Heterogeneity among the included studies was assessed using the I^2 statistic, with values above 50% indicating substantial heterogeneity. In addition, publication bias was evaluated through a funnel plot, while a forest plot was generated to visualize the overall effect sizes. I2 statistic was used to determine the heterogeneity in studies. Heterogeneity was considered substantial when I2 was > 50 % and fixed effects model for I2 values < 50 %. To assess the robustness of the findings, sensitivity analyses were performed by sequentially excluding studies with a high risk of bias and reanalyzing the data. A p-value of less than 0.05 was considered statistically significant (Higgins *et al*., 2022; Zelko *et al*., 2014).

RESULTS

Study Selection

The initial search strategy across multiple databases identified 127 potentially relevant studies. After removing 43 duplicates, 84 unique studies were screened based on their titles and abstracts. Of these, 4 articles were subjected to a full-text review to assess their eligibility against the inclusion criteria (Table I). Ultimately, 2 studies were included in the meta-analysis (Table II). The primary reasons for exclusion of the other studies in the systematic review were the lack of separate reporting of nasal measurements for female patients (n = 20), the inclusion of mixed surgical procedures other than rhinoplasty (n = 9), and inadequate data for statistical analysis (n = 45). The PRISMA flow diagram detailing the study selection process is presented in Figure 1, illustrating the rigorous methodology used to ensure only the most relevant studies were included (Higgins *et al*., 2022; Moher *et al*., 2009).

Table I. Study characteristic of 2 eligible studies included in systematic review.

No	Author	Study Design	JBI Score	Study Population	Mean Age	Mean± SD Nasal Measurements			Surgery/ Non-Surgery	Diagnostic	Outcome
						Width	Height	Index			
1	Mirashrafi *et al.* 2020 https://doi.org/10.1016/j.ijporl.2021.110717	Observational prospective	10/10	29 (10 cleft lip females, 19 males)	3.87 ± 1.19 months	1.04±0.43	-	-	Surgery (Millard Technique)	AutoCAD software	Significant improvement in nostril height ratio and dome height
2	Grandoch *et al*., 2023 https://doi.org/10.1016/j.jobcr.2023.09.001	Cross sectional	9/10	86 (28 cleft lip females, 58 males)	2–18 years	P (male) = 0.0185, p (female) = 0.006)	-	-	Surgery (Tennison-Randall technique)	Dental Software Power	Good symmetry of the nose postoperatively
3	Seo *et al*., 2019 https://doi.org/10.3390/jcm8050602	Cross sectional	10/11	45 (18 cleft lip females, 27 control females)	19.4 ±2 .2 years	37.35 ± 2.56	47.49 ± 3.26	79.13 ± 9.03	Non-surgery	Photogrammetric Analysis 3dMD system (3dMD LLC, Atlanta, GA, USA)	Primary rhinoplasty does not interfere with nasal growth
4	Seo *et al*., 2020 https://doi.org/10.1097/prs.0000000000006744	Cross sectional	10/11	54 (27 cleft lip females, 27 control females)	19 ± 1 years	37.35 ± 2.56	47.49 ± 3.26	79.13 ± 9.03	Non-surgery	Photogrammetric Analysis 3dMD system (3dMD LLC, Atlanta, GA, USA)	Primary rhinoplasty does not interfere with nasal growth

Table II. Study characteristic of 2 eligible studies analyzed in meta-analysis.

No	Author	Study Design	JBI /NHS Score	Study Population	Mean Age	Nasal Measurements (µ± SD in mm)		Nasal Index	Diagnostic
						Width	Height		
1	Seo *et al*., 2019	Cross sectional	10/11	45 (18 cleft lip females, 27 control females)	19.4 ±2 .2 years	37.35 ± 2.56	47.49 ± 3.26	79.13 ± 9.03	Photogrammetric Analysis 3dMD system (3dMD LLC, Atlanta, GA, USA)
2	Seo *et al*., 2020a	Cross sectional	10/11	54 (27 cleft lip females, 27 control females)	19 ± 1 years	37.35 ± 2.56	47.49 ± 3.26	79.13 ± 9.03	Photogrammetric Analysis 3dMD system (3dMD LLC, Atlanta, GA, USA)

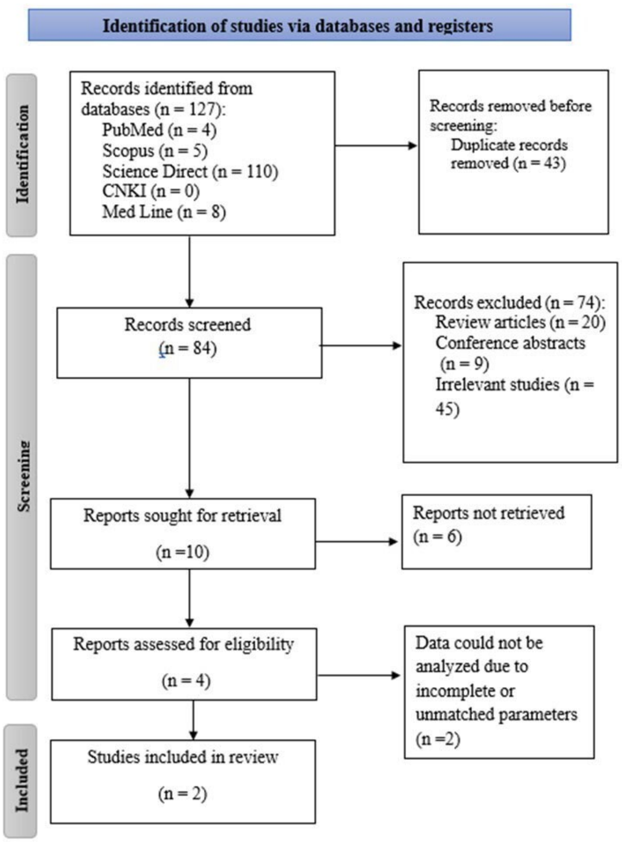

Fig. 1. PRISMA flow diagram showing the study selection process, resulting in the inclusiom of two studies for the final review.

Study Characteristics of included Systematic Review (n = 2)

Two studies were included in the qualitative synthesis of this systematic review (Table I). The first study by Mirashrafi *et al*. (2021), was a prospective observational study involving 29 infants with unilateral incomplete cleft lip (10 females, 19 males), with a mean age of 3.87 ± 1.19 months. Nasal symmetry was assessed using AutoCAD software, and significant improvements were reported in nostril height ratio and dome height following primary rhinoplasty using the Millard technique. The second study by Grandoch *et al*. (2023), employed a cross-sectional design with 86 patients (28 females, 58 males) aged between 2 and 18 years, thus exceeding the upper age limit of the present review's inclusion criteria. Nasal assessment in that study was performed using a novel method involving DentalSoftware Power, with reported improvements in post-operative nasal symmetry. Although both studies demonstrated favorable aesthetic outcomes, their heterogeneity in diagnostic methodology and patient age range rendered them unsuitable for inclusion in the meta-analysis. Specifically, Grandoch *et al*. (2023), did not meet the inclusion criterion regarding patient age (≤1 year), and both studies used non-comparable diagnostic tools, limiting the potential for quantitative synthesis (Mirashrafi *et al*., 2021; Grandoch *et al*., 2023).

Study Characteristics in the Meta-Analysis (n=2)

The two included studies identical in design and demographic focus. The study by Seo *et al*. (2019), focused on patients with bilateral cleft lip and palate (BCLP) who underwent primary rhinoplasty, with or without intermediate rhinoplasty, between 1995 and 2002 at Chang Gung Memorial Hospital in Taiwan. This retrospective study included 18 female patients (mean age: 19.4 ± 2 years) who had reached skeletal maturity and compared them with 27 normal controls. The researchers employed a high-resolution three-dimensional photogrammetric system to measure 10 linear, 4 angular, 6 proportional, 1 area, and 1 volume nasal parameter. This comprehensive evaluation aimed to assess the long-term impact of cleft rhinoplasty on nasal growth and morphology (Seo *et al*., 2019).

Another study by Seo *et al*. (2020a), conducted a retrospective comparative study using three-dimensional morphometric analysis to evaluate the long-term nasal growth outcomes in patients with unilateral cleft lip who underwent primary rhinoplasty. This study included 27 female patients (mean age: 19.4 ± 2 years) who had reached skeletal maturity and compared them with 27 normal controls. Patients who had reached skeletal maturity and compared their nasal morphology against age, sex, and ethnicity matched non-cleft controls. The analysis focused on parameters such as nasal index, nasal projection, surface area, and volume to determine the impact of early surgical intervention on nasal development (Seo *et al*., 2020a).

Across these studies, patient populations varied in terms of cleft status, and surgical history, but all employed reliable anthropometric or 3D morphometric methodologies, thereby contributing robust data for comparative analysis of nasal index and its relevance in surgical planning and outcomes (Seo *et al*., 2019; Seo *et al*., 2020a).

Risk of Bias in Studies

The risk of bias across the included studies was systematically evaluated using The Joanna Briggs Institute (2020) critical appraisal tools, which provided a structured approach to assess the methodological quality. In the 2 systematic reviews, the study of Mirashrafi *et al*. (2021), achieved a full methodological quality score (10/10) based on the JBI appraisal checklist. Nonetheless, Grandoch *et al*. (2023), received a JBI score of 9/10, indicating high methodological quality. Both studies reported positive aesthetic outcomes, with improved nasal symmetry postoperatively (Mirashrafi *et al*., 2021; Grandoch *et al*., 2023).

The studies by Seo *et al*. (2019), and Seo *et al*. (2020a), received a high JBI score of 10/11, indicating a robust study design with low risk of bias. Both studies recruited participants who had reached skeletal maturity, and used well-calibrated 3D-photogrammetric systems with validated anatomical landmarks and standardized protocols. These studies adequately identified and accounted for confounding factors by matching cleft patients with healthy controls based on age, sex, and ethnicity. They also ensured long-term follow-up and complete outcome data, minimizing attrition bias (Ioannidis, 2008; Seo *et al*., 2019; Seo *et al*., 2020a).

Results of Individual Studies included in the Meta-Analysis.

Previous study by Seo *et al*. (2019), contributed further to this discussion with a study that included 39 patients with bilateral cleft lip and palate (BCLP) in females (n=18) who underwent primary ± intermediate rhinoplasty and were followed into adulthood. This study found that female patients reported a mean of 40.24 ± 2.80 mm for nasal width, nasal height 48.86 ± 3.87 mm, and nasal index 83.16 ± 11.46 respectively. Compared to healthy female controls, patients had significantly wider alar base, shorter nasal tip projection, and increased nasal index, though overall nasal volume and surface area remained similar. This indicates that nasal growth was not stunted, but some features such as alar width and nasal tip angle were altered, likely due to scar tissue and structural repositioning from early surgery. Importantly, nasal index in female cleft patients remained in the mesorrhine range, higher than non-cleft controls, suggesting a broader nose shape post-surgery (2, 3). While Seo *et al*. (2020a), conducted a retrospective study used 3D morphometric analysis to assess nasal growth outcomes in female patients with unilateral cleft lip who had undergone primary rhinoplasty in infancy and reached skeletal maturity. Involving 52 total patients with female subgroup (n = 27) included in sex-based analysis. Female patients reported a mean of 47.49 ± 3.26 in nasal height, 37.35 ± 2.56 in nasal width, and 79.13 ± 9.03 in nasal index. The study found that primary rhinoplasty did not impair nasal growth, and female patients maintained normal nasal dimensions into adulthood. Most parameters, including nasal height and tip projection, were statistically comparable to matched controls, suggesting no long-term developmental restriction due to early surgery (Seo *et al*., 2020a).

Results of Synthesis (Nasal measurements in Female Cleft Lip Patients *vs.* Controls)

The meta-analysis was performed using a fixed-effect model to compare mean nasal width between female patients with cleft lips and healthy controls (Fig. 2). A total of 45 cleft lip patients and 54 controls were included across the two studies. Seo *et al*. (2019), reported a significantly greater nasal width in the cleft group (mean difference: 2.89 mm; 95% CI: 1.28 to 4.50), with an SD of 2.8 in cleft patients and 2.56 in controls. Whilst, Seo *et al*. (2020a), showed a non-significant difference in nasal width (mean difference: 0.31 mm; 95 % CI: -0.88 to 1.50), with relatively narrower variation across both groups. The overall pooled mean difference was 1.22 mm (95 % CI: 0.26 to 2.18, p = 0.01), indicating that, on average, female patients with cleft lip had wider nasal bases than healthy controls. Statistical heterogeneity among the studies was considerable, with I^2 = 84% and Chi^2 = 6.35 (df = 1, p = 0.01). This suggests substantial variation between the included studies, which may be attributed to differences in type of cleft (bilateral *vs.* unilateral), and presence or absence of intermediate rhinoplasty (Seo *et al*., 2019; Seo *et al*., 2020a; Di Chiaro *et al*., 2022).

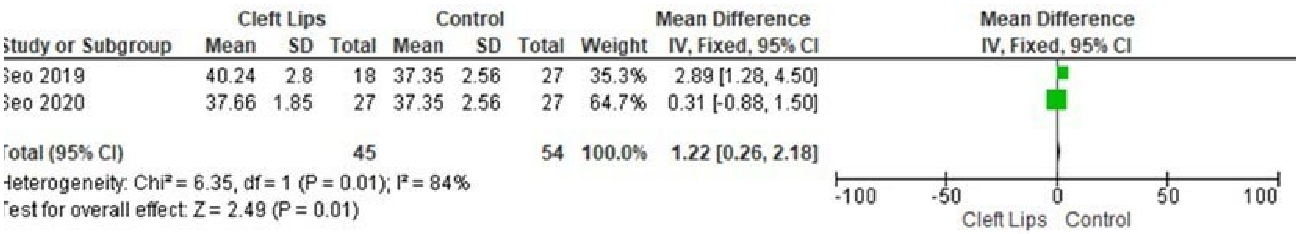

Fig. 2. Nasal width comparison between cleft lip and control in female forest plot, showed significant difference with greater measurement in patients with cleft lips.

Although individual study results varied, the combined analysis indicates a statistically significant increase in nasal width among female cleft lip patients compared to controls. This supports the notion that residual nasal widening may persist despite early rhinoplasty, and may be more pronounced in patients with bilateral cleft types (Seo *et al*., 2019; Seo *et al*., 2020a; Zelko *et al*., 2023).

Importantly, neither study reported negative effects on nasal growth, reinforcing the safety of primary rhinoplasty in early life. While patient-reported comfort and satisfaction were not quantitatively assessed, the maintenance of nasal volume and symmetry at skeletal maturity suggests favorable long-term outcomes (Seo *et al*., 2019; Seo *et al*., 2020a).

The meta-analysis comparing nasal height between female cleft lip patients and healthy controls based on two studies (Fig. 3), showed no statistically significant difference in nasal height at skeletal maturity. The pooled mean difference was 0.77 mm (95 % CI: -0.49 to 2.04; p = 0.23), with negligible heterogeneity (I^2 = 0%). In Seo *et al*. (2019), the cleft group had a slightly higher nasal height (mean 48.86 mm) compared to controls (47.49 mm), while Seo *et al*. (2020a), reported nearly identical values between groups. These findings suggest that vertical nasal growth is largely preserved following primary rhinoplasty in infancy, regardless of cleft type. The consistency across studies supports the clinical safety of early nasal correction, indicating that early surgical intervention does not impair long-term nasal height development in female patients (Seo *et al*., 2019; Seo *et al*., 2020a; Zelko *et al*., 2023).

The meta-analysis comparing nasal index between female cleft lip patients and healthy controls, based on two studies revealed no statistically significant difference (Fig. 4). The pooled mean difference was 0.92 (95 % CI: -2.50 to 4.34; p = 0.60), indicating no overall difference in nasal index between groups. In the Seo *et al*. (2019), study involving bilateral cleft lip patients, the cleft group had a higher nasal index (mean = 83.16, SD = 11.46) compared to controls (mean = 79.13, SD = 9.03), although the difference was not significant (MD = 4.03; 95 % CI: -2.27 to 10.33). Conversely, Seo *et al*. (2020a), which included patients with unilateral cleft lip, found a slightly lower mean nasal index in the cleft group (mean = 78.75, SD = 5.90) compared to controls (mean = 79.13, SD = 9.03), with a non-significant mean difference of -0.38 (95 % CI: -4.45 to 3.69). The heterogeneity was low (I^2 = 25 %), indicating consistent results across studies. Clinically, these findings suggest that the nasal index—a measure reflecting nasal width relative to height—remains stable and comparable to non-cleft individuals in female patients following primary rhinoplasty, regardless of cleft type or laterality, supporting the long-term safety of early surgical intervention (Seo *et al*., 2019; Seo *et al*., 2020a; Zelko *et al*., 2023).

The authors concluded that patient expectations are largely influenced by prevailing aesthetic norms favoring narrower nasal shapes. The potential for early rhinoplasty to improve appearance and reduce psychological burden during early development, especially among female patients. In addition to these findings, each study also highlighted the importance of the morphometric harmony observed supports favorable aesthetic and functional outcomes in the long term, especially for female patients where nasal refinement is often more favored. Also, the data emphasize the importance of aligning surgical planning with culturally specific nasal profiles and aesthetic desires (DiChiaro *et al*., 2023; Kabakci *et al*., 2020).

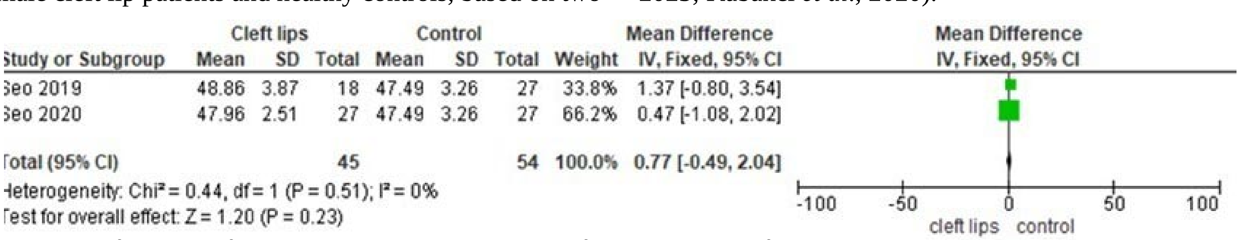

Fig. 3. The forest plot of nasal height comparison between cleft lip and control in female. It was larger in the patients than in control, although not significant.

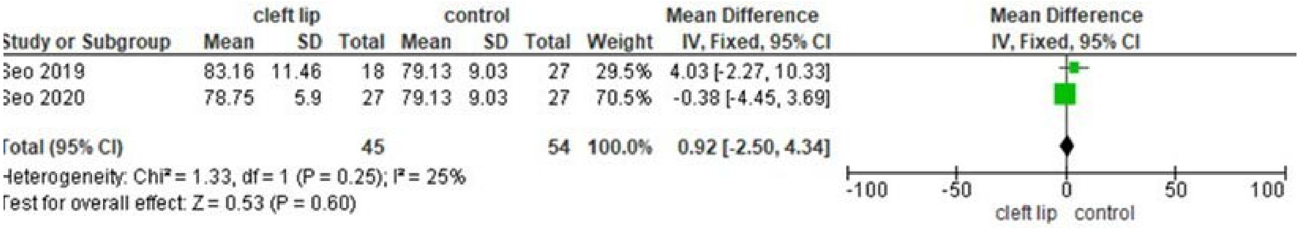

Fig. 4. The forest plot of nasal index comparison between cleft lip and control in female. It was larger in the patients than in control, although not significant.

A sensitivity analysis was conducted to assess the robustness of the pooled results and to explore the potential influence of individual studies on overall outcomes. By sequentially excluding each study from the meta-analysis of nasal width, nasal height, and nasal index, no significant changes were observed in the direction or significance of the pooled effect sizes. This indicates that the overall findings were not disproportionately driven by any single study. In addition, sensitivity analysis confirmed the stability of results despite the variability in cleft types (unilateral vs. bilateral) and slight methodological differences across studies. The low to moderate heterogeneity observed (I^2 ranging from 0 % to 84 %) suggests acceptable consistency, further supporting the reliability of the conclusions drawn from this meta-analysis (Higgins *et al*., 2022).

Reporting Bias

To assess the potential for publication bias, a funnel plot was constructed and visually inspected. The funnel plot for nasal width (Fig. 5.1a) demonstrates a slight asymmetrical distribution of the two included studies along the central vertical axis, with both points falling within the pseudo–95 % confidence limits. Despite the small number of studies, no substantial asymmetry is observed, suggesting a low likelihood of reporting bias. However, due to the inclusion of only two studies, the reliability of funnel plot interpretation is inherently limited, as visual asymmetry is less meaningful with small sample sizes. According to Sterne *et al*. (2011), funnel plots become more informative when ten or more studies are included, and interpretations based on fewer studies should be made with caution (Ioannidis, 2008; Sterne *et al*., 2011; Page *et al*., 2021). Nevertheless, the current findings do not raise any visual concern for publication bias in nasal width outcomes.

Similarly, the funnel plot assessing nasal height (Fig. 5.1b) also appears symmetrical, with the two studies positioned near the central axis and within the defined funnel boundaries. No apparent asymmetry or skew is detected, indicating no strong evidence of selective reporting bias. Both studies demonstrated non-significant results, which also reduces the risk of positive results publication bias—a phenomenon where only statistically significant findings are reported. This aligns with recommendations by the Cochrane Handbook, which emphasizes that small-study effects and selective outcome reporting are unlikely to be reliably detected unless more studies are available for comparison (Ioannidis, 2008; Higgins *et al*., 2022). Thus, while no bias is evident, further studies would be required to confirm the stability of the estimate.

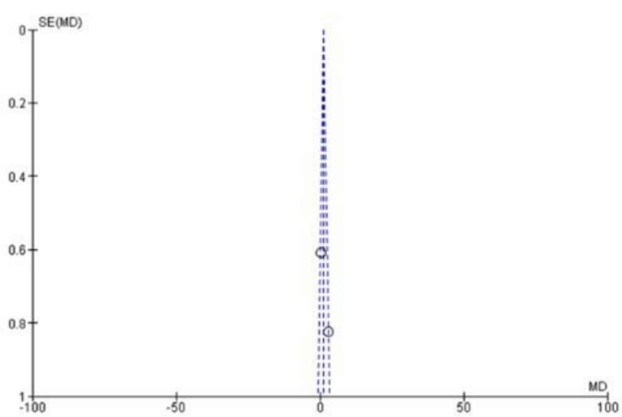

Fig. 5. 1a. Funnel plot of nasal width in female illustrating the distribution of the included studies within the pseudo–95 % confidence limits.

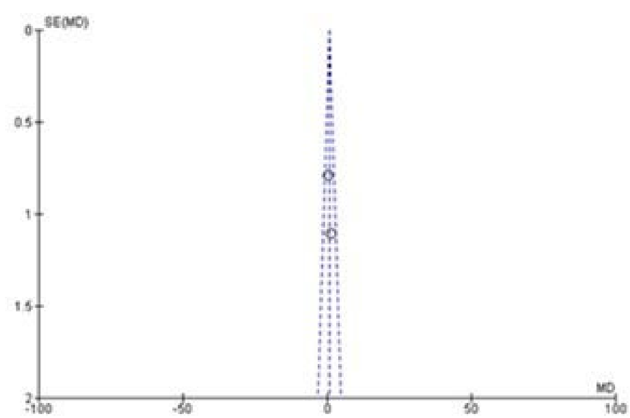

Fig. 5. 1b. Funnel plot of nasal height in female illustrating the distribution of the included studies within the pseudo–95 % confidence limits.

The funnel plot for nasal index (Fig. 5.2) shows a vertically aligned distribution of the two studies with slight variation in standard error, but still within the expected confidence limits and without visible asymmetry. Although the variation in effect sizes appears slightly wider than the previous outcomes, the distribution remains centered around the null line, and there is no visual indication of significant publication bias. This result supports the notion that both positive and null findings were equally reported by the included studies. Nonetheless, as pointed out by Ioannidis (2008), conclusions regarding reporting bias from funnel plots with fewer than 10 studies should be regarded as exploratory rather than confirmatory, and should be supplemented by other tools such as Egger's test or trial registries when available (Ioannidis, 2008).

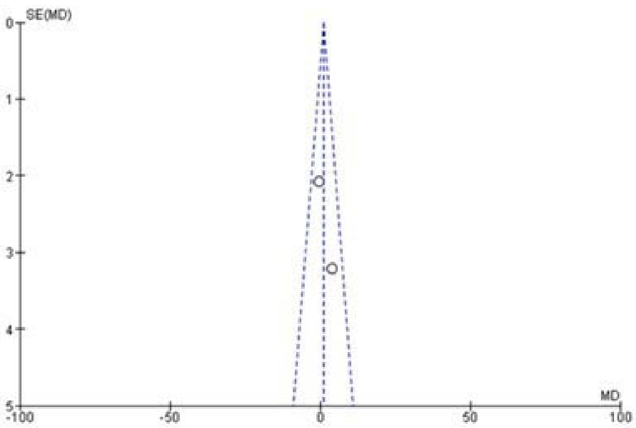

Fig. 5.2. Funnel plot for nasal index in female showing the distribution of the included studies within the pseudo–95 % confidence limits.

DISCUSSION

This systematic review and meta-analysis investigated the nasal measurements—specifically nasal width, nasal height, and nasal index—in female patients with cleft lip who underwent early primary rhinoplasty, in comparison with healthy controls. The findings demonstrate that while nasal width was significantly increased in cleft patients, nasal height and nasal index showed no statistically significant differences, indicating that vertical nasal growth and proportionality are generally preserved post-operatively (Seo *et al*., 2020a; Zelko *et al*., 2023).

The observed increase in nasal width among cleft patients aligns with previously reported literature on post-rhinoplasty outcomes in patients with cleft deformities, particularly bilateral types. Seo *et al*. (2019), demonstrated a wider alar base and reduced nasal tip projection in patients with bilateral cleft lip, suggesting persistent lateral nasal expansion despite early surgical correction. Conversely, Seo *et al*. (2020a), reported no significant discrepancy in nasal height and index among patients with unilateral clefts, supporting the notion that early intervention does not adversely affect longitudinal nasal development. This is consistent with growth studies suggesting that midfacial development follows relatively stable trajectories when appropriate primary repair techniques are employed. Findings reinforced by systematic analysis in 2022 and 2023, which showed that 15 of 16 objective assessments supported early primary rhinoplasty without growth restriction. Supporting this, Kabakci *et al*. (2020), examined the morphometry of the piriform aperture—a key bony component of nasal base structure—and found that its width increases with age, particularly after the third decade of life, and is significantly influenced by sex and ethnicity. These anatomical norms provide valuable context, especially since female cleft patients with wider nasal bases may deviate from conventional aesthetic expectations, underscoring the need for tailored surgical planning (Kabakci *et al*., 2020).

The findings from both Mirashrafi *et al*., (2021) and Grandoch *et al*. (2023) underscore the importance of nasal symmetry as a critical outcome in cleft lip repair, though each study approached the assessment from distinct methodological and demographic angles. Mirashrafi *et al*., (2021) focusing on infants under six months of age, demonstrated significant improvements in objective nasal indices such as nostril height ratio and naso-labial angle following primary rhinoplasty, with long-term follow-up supporting the durability of outcomes. Conversely, Grandoch *et al*., introduced an innovative digital measurement protocol to assess nasal asymmetry in older patients (aged 2–18 years), reporting gender-specific variations in nasal width postoperatively. While the studies reinforce the aesthetic benefit, both demonstrated that primary surgical correction of nasal deformity in cleft lip patients contributes positively to patient satisfaction and aesthetic outcomes. Mirashrafi *et al*. (2021), reported a significant improvement in parental satisfaction scores (VAS) following early primary rhinoplasty, suggesting enhanced psychosocial acceptance and perceived nasal symmetry. Although Grandoch *et al*., did not directly assess satisfaction scores, the detailed nasal morphometric improvements, particularly in nasal width and shape, imply potential functional and psychosocial benefits, especially considering the older patient cohort. Importantly, neither study reported major postoperative complications, and no functional impairments were observed, supporting the overall safety and effectiveness of early nasal correction. These findings underscore the dual benefit of cleft nasal surgery—achieving both improved facial harmony and a higher level of patient or caregiver satisfaction without compromising nasal function. The study by Imre & Yılmaz

(2024) and a study comparing Caucasian and East Asian population demonstrated that individuals with higher educational backgrounds and interest in visual arts were more likely to prefer facial proportions—such as nasal index and naso-oral ratios—closely aligned with the golden ratio. In addition, the findings can be contextualized within aesthetic principles such as the golden ratio (F = 1.618), which has long been considered a guiding benchmark in facial plastic surgery. In the context of rhinoplasty among cleft lip patient, this suggests that surgical outcomes perceived as harmonious may rely not only on absolute measurements but also on culturally and psychologically shaped ideals of proportion (Kulkarni *et al*., 2019; Imre & Yilmaz, 2024; Durum Polat *et al*., 2024).

A major strength of this review lies in its inclusion of studies that applied objective and innovative measurement tools to assess nasal symmetry outcomes in cleft lip patients. The high methodological quality of both studies, as assessed by the JBI checklist, enhances the reliability of their findings. Furthermore, the inclusion of both short-term and long-term postoperative assessments provides valuable insight into the durability of aesthetic outcomes over time. However, several limitations must be acknowledged. The small number of eligible studies, along with their methodological heterogeneity—particularly in terms of patient age, surgical techniques, and nasal measurement methods—limited the possibility of conducting a quantitative meta-analysis. Additionally, while one study included validated satisfaction outcomes, the other did not formally assess patient-reported orfunctional measures such as nasal air-flow or breathing quality. These gaps highlight the need for future studies with standardized outcome reporting and consistent diagnostic approaches to better inform clinical practice and evidence synthesis in cleft nasal surgery.

CONCLUSIONS

Primary rhinoplasty performed in infancy could preserve nasal measurements close to the physiological and functional values towards adulthood. The weight of available evidence supports both anatomical safety and high long-term satisfaction, with relatively low rates of revision surgery. Nevertheless, continued longitudinal re-search counts varied demographic inclusion, and multi-surgeon cohorts is needed to refine technique, optimize outcomes, and ensure consistent aesthetic and functional results for cleft lip palate patients.

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KOSASIH, S. J. & KALANJATI, V. P. Índice nasal y su correlación con los resultados de la rinoplastia: Una revisión sistemática y meta análisis. *Int. J. Morphol., 44(3)*:949-958, 2026.

RESUMEN: La morfología nasal en pacientes con labio hendido desempeña un papel fundamental tanto en el equilibrio estético como en la integridad funcional. El índice nasal es una medida antropométrica clave que determina el plan quirúrgico y el resultado en las deformidades por labio leporino. Se realizó una búsqueda sistemática de la literatura siguiendo las directrices PRISMA. Se incluyeron estudios que evaluaban las dimensiones nasales en pacientes femeninas con labio hendido tras una rinoplastia primaria temprana, en comparación con controles sanos, utilizando métodos fotogramétricos o morfométricos 3D. Los datos se sintetizaron con RevMan 5.4.1 y se calcularon las diferencias medias combinadas para el ancho, la altura y el índice nasal. El riesgo de sesgo se controló mediante las herramientas de evaluación JBI. Dos estudios elegibles (casos *vs*. controles: n=45 *vs.* 54; µ±DE= 19,18 años) se incluyeron en la síntesis cuantitativa. En los pacientes, el diagnóstico más común fue el de pacientes consecutivos no sindrómicos con deformidad unilateral de labio hendido y nariz que se sometieron a rinoplastia primaria. El meta análisis mostró que el ancho y la altura nasal en los pacientes fueron mayores que en los controles (DM = 1,22 mm, IC del 95 %: 0,26 a 2,18, p = 0,01, I^2 = 84 %; DM = 0,77 mm, IC del 95 %: -0,49 a 2,04, p = 0,23, I^2 = 0 %, respectivamente). El índice nasal no reveló diferencias estadísticamente significativas (DM = 0,92, IC del 95 %: -2,50 a 4,34, p = 0,60, I^2 = 25 %). El número limitado de estudios restringe la interpretación concluyente, aunque los hallazgos fueron consistentes en los análisis de sensibilidad.

PALABRAS CLAVE: Índice nasal; Rinoplastia; Labio hendido y paladar hendido; Resultados de salud.

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