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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

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GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საქურაღებოლ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დაიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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ANALYSIS OF THE EFFECTIVENESS OF SURGICAL METHODS IN THE TREATMENT OF CLEFT PALATE

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Abstract.

Background: Cleft palate is one of the most significant congenital craniofacial anomalies and remains an important clinical and public health concern. The incidence of cleft palate continues to increase in many regions worldwide, highlighting the need for effective surgical management and improved treatment strategies. The primary goal of palatoplasty is the anatomical restoration of palatal integrity to enable normal speech development while minimizing the risk of oronasal fistula formation and promoting long-term harmonious growth of the facial skeleton.

Objective: This study aimed to evaluate and compare the effectiveness of different palatoplasty techniques in children with cleft palate based on functional, anatomical, and aesthetic outcomes.

Methods: The systematic review was conducted based on an analysis of English-language publications published between 1980 and 2026. A comprehensive literature search was performed in major international bibliographic databases to identify relevant studies on palatoplasty techniques in patients with cleft palate. The literature search was conducted in the following electronic databases: MEDLINE (via PubMed), EMBASE, the Cochrane Oral Health Group's Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL), and Google Scholar. In addition, the reference lists of the included studies were manually screened to identify additional relevant publications.

Results: A total of 47 studies were included in the systematic review, of which 26 studies were included in the meta-analysis, while the remaining studies were analyzed qualitatively. The meta-analysis of oronasal fistula incidence showed extremely high heterogeneity among studies ($I^2 = 98.8\%$). The pooled standardized mean difference was 1.64 (95% CI: -2.49 to 5.57; $p = 0.437$). The pooled standardized mean difference for hypernasality was 0.50 (95% CI: -0.49 to 1.48; $p = 0.3227$). The analysis of soft palate length showed very high heterogeneity among studies ($I^2 = 96.9\%$). The pooled standardized mean difference was 0.22 (95% CI: -2.40 to 2.84; $p = 0.87$).

Conclusion: The meta-analysis suggests that functional outcomes of palatoplasty are mainly influenced by the quality of surgical reconstruction, accurate muscle repositioning, tissue tension and surgeon experience, while the specific surgical technique appears to play a secondary role.

Key words. Palatoplasty technique, cleft palate, functional, anatomical, aesthetic outcomes.

Introduction.

The prevalence of cleft lip and palate in Asian countries varies and can reach approximately 1.33 cases per 1,000 live births [1]. The average prevalence of cleft lip was 1.96 cases per 1,000 newborns between 2006 and 2018 [2]. The overall prevalence of orofacial clefts in South Korea was 11.09 per 10,000 live births, including 5.57 per 10,000 cases of isolated cleft palate and 2.75 per 10,000 cases of combined cleft lip and palate. During the study period, the proportion of orofacial clefts increased from 3.6% to 4.1% [3].

According to a retrospective study based on data from the regional registries of congenital anomalies (IMER and RTDC), the mean prevalence of orofacial clefts in Italy between 2001 and 2014 was 1.03 per 1,000 live births, ranging from 0.9 to 1.1 per 1,000 [4].

According to the international registry IPDTC (International Perinatal Database of Typical Oral Clefts), during the period from 2000 to 2005, the prevalence of cleft lip in Japan was 20.0 per 10,000 live births, which is almost twice as high as the rates reported in the United States (10.2 per 10,000) and South Korea (11.09 per 10,000) [5].

Meanwhile, in Brazil this rate was 6.73 per 10,000 live births during the period 2010–2021 [6].

The primary goal of palatoplasty is anatomical restoration of palatal integrity to enable normal speech development, while minimizing the risk of oronasal fistula formation and promoting long-term harmonious growth of the facial skeleton [7,8].

Various surgical techniques are used for cleft palate repair including the von Langenbeck technique, the Veau–Wardill–Kilner pushback procedure, Furlow's double-opposing Z-plasty, and buccal mucosal flaps. The choice of technique is individualized, considering the anatomical characteristics of the cleft, its width and length, patient age, tissue condition, and functional goals—primarily the achievement of adequate velopharyngeal competence. Each method has specific advantages and limitations and is associated with potential complications, including oronasal fistula formation, scarring, maxillary growth impairment, and velopharyngeal insufficiency [9–14]. Surgical treatment of cleft palate is one of the most

difficult tasks in maxillofacial surgery. Achieving a good result requires aesthetically and functionally complete closure of the defect without disrupting the growth of the facial skeleton, which provides conditions for normal speech development [15].

One of the most significant intraoperative complications is bleeding, which occurs during mobilization of the palatal soft tissues, dissection of mucoperiosteal and musculomucosal flaps, and transection of vascular structures [16,17].

Intraoperative bleeding not only creates technical difficulties for the surgeon but also reduces visualization of the surgical field, increases the risk of errors in flap design and raises the likelihood of injury to adjacent anatomical structures [18].

Incomplete closure of the hard palate may lead to complications such as the formation of an oronasal fistula of sufficient size to cause nasal regurgitation and speech impairment [19].

The formation of an oronasal fistula is a challenging postoperative complication of palatoplasty, leading to nasal air leakage during speech and swallowing. A concerning global trend toward an increasing incidence of oronasal fistulas has been demonstrated in several studies [17,20].

Oronasal fistula size varies: small fistulas are primarily caused by separation and desiccation of mucoperiosteal flaps, whereas large fistulas result from extensive flap necrosis due to impaired vascular supply during mobilization [21].

Postoperative palatal fistulas usually require surgical repair to prevent these complications. However, repeated attempts at fistula closure promote scar formation and are associated with a high risk of fistula formation [16].

The potential impact of primary palatoplasty and its complications on maxillary growth and facial skeleton development also remains controversial. Although some retrospective studies report a low incidence of maxillary hypoplasia, further long-term follow-up is required to evaluate the influence of surgical timing and technique on craniofacial growth [22].

Velopharyngeal insufficiency is one of the most common complications following palatoplasty and is caused by anatomical insufficiency that prevents adequate velopharyngeal closure, leading to severe speech disorders [23].

Primary palatoplasty performed between 6 and 12 months of age has been associated with a significantly lower risk of velopharyngeal insufficiency (VPI). These findings support the long-established concept that the timing of surgery plays an important role in postoperative speech development and long-term functional outcomes [24].

The assessment of the effectiveness of various palatoplasty techniques, including their advantages and limitations, in the context of functional and anatomical outcomes remains a subject of scientific debate. The main purpose of the meta-analysis is to determine the effectiveness of currently used techniques in palatoplasty and to analyze the characteristics of the postoperative period, including the incidence of complications and functional outcomes [25].

The aim of this study was to systematically evaluate and compare the effectiveness of different palatoplasty techniques in children with cleft palate based on reported functional, anatomical, and aesthetic outcomes.

Materials and Methods.

This systematic review was conducted in accordance with the PRISMA guidelines (PRISMA 2009 checklist). The following questions were formulated in PICO format (Patient, Intervention, Comparison, Outcome) to summarize the objectives and criteria for patient inclusion.

Focused question:

How do different methods of primary palatoplasty influence the incidence of complications and the aesthetic and functional outcomes in children with congenital cleft palate?

P- Children with congenital cleft palates up to 18 years of age
I – methods palatoplasty

C – Comparisons between the following surgical techniques were analyzed: One-stage versus two-stage palatoplasty, secondary Furlow palatoplasty versus buccal myomucosal flap; von Langenbeck versus Bardach two-flap palatoplasty; primary palatoplasty with conventional intravelar veloplasty versus primary palatoplasty with acellular dermal matrix (ADM); double-opposing Z-plasty (DOZ) versus buccal fat pad (BFP) coverage; conventional DOZ versus small DOZ; Furlow palatoplasty versus two-flap palatoplasty; Furlow palatoplasty versus straight-line intravelar veloplasty; FA versus FB techniques; and straight-line repair versus Furlow repair.

Outcomes – Functional outcomes; speech (hypernasality and intelligibility), soft palate length, eustachian tube dysfunction.

Surgical: frequency of fistulas, suture dehiscence, bleeding during and after surgery, respiratory complications, duration of surgery, length of hospital stay.

Search strategy

The systematic review was based on an analysis of English-language publications. The observation covered the period from 1980 to 2026. The literature search was conducted in major international bibliographic databases, including.

1. MEDLINE (PubMed)
2. EMBASE
3. The Cochrane Oral Health Group's Trials Register
4. The Cochrane Central Register of Controlled Trials
5. Google
6. Reference list of publications (Bibliographies)
("Cleft Palate"[Mesh] OR "cleft palate" OR "palatoplasty")
AND ("children" OR "pediatric" OR "paediatric")
AND ("One-Stage Palatoplasty" OR "Two-Stage Palatoplasty"
OR "Furlow" OR "Secondary Furlow"
OR "Buccal Myomucosal Flap" OR "Von Langenbeck" OR
"Bardach"
OR "Intravelar Veloplasty" OR "ADM" OR "DOZ" OR "BFP"
OR "Two-flap palatoplasty"
OR "Straight-line Intravelar Veloplasty" OR "FA" OR "FB")
AND ("intraoperative complication" OR "postoperative
complication" OR "bleeding" OR "wound dehiscence"
OR "fistula" OR "hypernasality" OR "speech outcome" OR
"Eustachian tube dysfunction")

Inclusion criteria:

1. **Language of publication:** studies published in English.
2. **Type of studies:**
Randomized controlled trials (RCTs)

Controlled clinical trials (CCTs)
Cohort studies (prospective or retrospective)
Retrospective studies

3. Population: Children with congenital cleft palate up to 18 years of age.

4. Intervention: Any surgical technique of palatoplasty, including: One-Stage, Two-Stage, Furlow, Two-flap, Von Langenbeck, Bardach, DOZ, BFP, ADM, Intravelar Veloplasty, and others.

Exclusion criteria:

1. Studies not published in English.
2. Studies without patients with congenital cleft palate (e.g., only cleft lip or acquired defects).
3. Articles not reporting data on palatoplasty/palatoplasty surgical techniques.
4. Conservative treatment or orthodontic interventions without surgery.
5. Studies lacking data on intraoperative or postoperative complications, functional, or aesthetic outcomes

Data extraction: Author, Study design, Years, Number of patients, Outcome, Surgical technique, Length of hospital stay, Duration of surgery, Fistula frequency, Hypernasality, Length soft palate, Speech intelligibility, Wound dehiscence, Bleeding intraoperative, Postoperative bleeding, Airway obstruction.

Risk of Bias Assessment:

For randomised controlled trials (RCTs), the assessment was performed using the RoB 2 (Risk of Bias 2) tool.

For non-controlled and cohort studies, the ROBINS-I (Risk of Bias In Non-randomised Studies of Interventions, sometimes referred to as RoB 1 for non-controlled studies) tool was used.

Statistical analysis:

All data were collected and processed using Microsoft Excel. Meta-analysis was performed using Meta-Analysis software. A random-effects model was applied to pool data in cases of high heterogeneity. Heterogeneity was assessed using I^2 and χ^2 statistics, and results were reported with 95% confidence intervals (CI). This approach allowed combining results from different studies and evaluating the overall incidence of complications and functional outcomes following various palatoplasty techniques.

Results.

A total of 400 records were identified through database searching using Boolean operators ($n = 280$) and additional keyword-based searches ($n = 120$). After screening titles and abstracts, 250 records were excluded due to irrelevance, leaving 150 full-text articles assessed for eligibility.

Of these, 103 articles were excluded following full-text evaluation based on predefined exclusion criteria, including review articles ($n = 47$) and other reasons ($n = 56$).

Ultimately, 47 studies met the inclusion criteria and were included in the systematic review. Of these, 26 studies were eligible for quantitative synthesis and were included in the meta-analysis (Figure 1).

Risk of Bias:

The randomized controlled trials by Reddy et al. (2018) and

Tageldeen et al. (2025) demonstrated a low risk of bias. In contrast, the non-randomized studies were at higher risk of bias due to their study design (Figure 2).

For the non-randomized studies, the risk of bias varied among the included studies. The studies by Hodge et al. (2010), Schonmeyer et al. (2016), Deshpande et al. (2014), Moore et al. (1988), Peyvaste et al. (2023), Yi et al. (2021), Park et al. (2022), Hattori et al. (2024), Dong et al. (2012), Lignieres et al. (2024), Trotter et al. (2025) were assessed as having a low risk of bias. The study by Adamson et al. (2026) was rated as having a high risk of bias, while the remaining studies were judged to have a moderate risk of bias (Figure 3).

Length of Hospital Stay (Bed-Days):

Ten studies with a total of 5241 participants were included in the meta-analysis (Table 1). A random-effects model was used to pool the data.

The pooled mean across all studies was 3.59 days (95% CI: 2.77–4.41) (Figure 4). The prediction interval demonstrated substantial variability (0.75–6.44), reflecting heterogeneity in outcomes across individual studies.

The heterogeneity analysis indicated extremely high between-study variability:

- $I^2 = 99.9\%$, suggesting that nearly all observed variability was attributable to differences between studies rather than sampling error;
- $\tau^2 = 0.8748$;
- $\chi^2 = 7809.50$, $df = 4$, $P < 0.001$, further confirming statistically significant heterogeneity.

Therefore, the average value obtained should be interpreted as a guideline rather than a universal standard. The actual length of hospitalization is determined by several factors, including patient age, type and severity of the cleft, surgical technique used, presence of complications, specifics of postoperative care, and local clinical protocols.

To further explore the sources of heterogeneity a subgroup analysis based on study design (prospective vs retrospective) was performed. The pooled mean length of hospital stay in retrospective studies was 4.00 days (95% CI: 2.55–5.44) (Figure 5). The prospective subgroup included only one study with a mean LOS of 2.00 days. A statistically significant difference between subgroups was observed ($p = 0.0067$). However, this finding should be interpreted with caution due to the limited number of prospective studies.

Duration of Surgery:

A total of six studies comprising nine comparisons were analyzed, including 509 patients in the meta-analysis. The reported mean values ranged from 65.23 to 173.40 minutes. The analysis included the following surgical techniques: one-stage primary palatoplasty, Bardach two-flap palatoplasty, modified two-flap palatoplasty, Furlow double-opposing Z-plasty, rotational flap palatoplasty, two-flap palatoplasty with intravelar veloplasty, and the Sommerlad technique. In some studies, buccal fat pad coverage was used as an adjunctive procedure (Table 2).

The pooled mean duration of surgery was 128.05 minutes (95% CI: 107.52–148.59) (Figure 6). The prediction interval ranged from 57.49 to 198.62 minutes, indicating substantial variability that may be expected in future studies.

Table 1. Length of Hospital Stay (Bed-Days).

Author	year	study design	number of patients	mean LOS (days)	SD
Adamson et al.[26]	2026	prospective interventional study	145	2	0.18
Nguyen et al.[27]	2014	retrospective	14	2	0.04
Cronin et al. [28]	2001	retrospective	79	3.50	1.11
Blough et al.[29]	2019	retrospective	3616	3	ND
Izadi et al.[30]	2012	retrospective	406	1.5	0.45
Wood et al.[31]	2015	retrospective	100	1.6	ND
Eaton et al.[32]	1994	retrospective	398	2	ND
Chao et al.[33]	2018	retrospective	75	2.7	ND
Onyekwelu et al. [34]	2016	retrospective	79	1.72	ND
Canady et al. [35]	1994	retrospective	329	9	1.5

Note: LOS — length of stay; SD — standard deviation; ND — not determined.

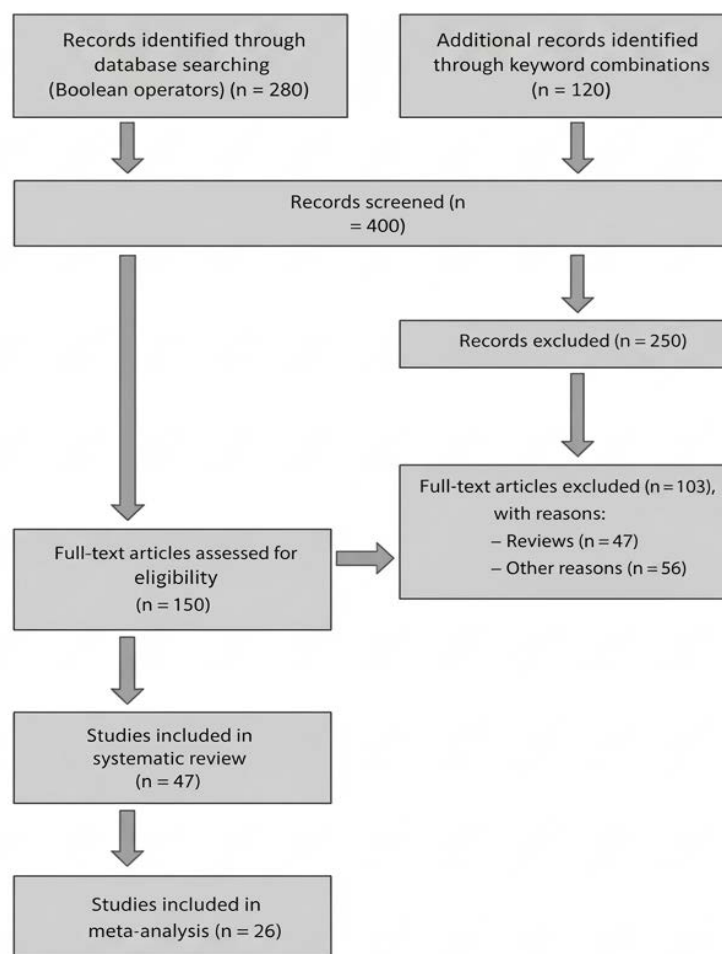


Figure 1. Ultimately, 47 studies met the inclusion criteria and were included in the systematic review. Of these, 26 studies were eligible for quantitative synthesis and were included in the meta-analysis.

Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Reddy et al. (2018)	+	+	+	+	+	+
Tageldeen et al. (2025)	+	+	+	+	+	+

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
+ Low

Figure 2. The non-randomized studies were at higher risk of bias due to their study design.

Study	Risk of bias domains							Overall
	D1	D2	D3	D4	D5	D6	D7	
Adamson et al.(2026)	-	●	?	?	+	-	-	●
Nguyen et al.(2014)	-	?	-	+	+	+	-	-
Cronin et al.(2001)	-	-	+	-	+	+	+	-
Blough et al. (2019)	●	-	+	+	-	-	+	-
Izadi et al. (2012)	-	●	+	+	-	-	-	-
Wood et al.(2015)	-	-	+	-	-	●	-	-
Eaton et al.(1994)	-	●	+	+	●	-	+	-
Chao et al. (2018)	-	+	●	-	+	●	-	-
Onyekwelu et al.(2016)	-	●	+	+	+	●	-	-
Canady et al.(1994)	●	+	+	+	●	-	●	-
Brudnickiet al.(2017)	-	●	+	●	+	+	+	-
Degala et al.(2025)	●	-	+	●	-	-	+	-
Kaewkumsn et al.(2020)	●	-	+	+	-	-	+	-
Hodge et al.(2010)	+	+	+	+	+	+	-	+
Nastril Kalla et al. (2022)	-	+	●	-	+	-	-	-
Schonmeyer et al.(2016)	-	+	+	-	+	-	-	+
Mahajan et al. (2024)	-	+	●	-	+	●	-	-
Ruslin et al. (2019)	●	-	+	+	-	-	+	-
Zhang et al.(2014)	●	-	+	+	-	●	+	-
Kim et al. (2018)	●	-	+	+	-	-	+	-
Pena et al.(2000)	+	-	+	+	-	-	+	-
Sullivan et al. (2024)	●	-	+	+	-	-	+	-
Blough et al. (2018)	-	-	-	-	+	+	-	-
Adenek et al. (2011)	-	-	+	-	-	-	-	-
Antony et al.(2002)	-	-	+	●	-	●	-	-
Cohen et al.(2022)	-	-	+	-	-	-	-	-
Isch et al. (2025)	-	-	+	●	-	●	-	-
Park et al.(2016)	-	-	+	-	-	●	-	-
Adesina et al.(2016)	-	-	+	●	-	●	-	-
Rossel-Perry et al.(2013)	-	+	-	●	+	●	-	-
Deshpande et al.(2014)	-	+	+	+	+	●	-	+
Bosi et al. (2016)	-	+	-	-	+	●	-	-
Paine et al. (2016)	-	+	●	-	+	●	-	-
Kochar et al.(2021)	-	+	●	-	+	+	-	-
Prosak et al.(2025)	-	+	●	-	+	●	-	-
Nasomtrug et al. (2016)	-	-	+	-	-	+	-	-
Moore et al.(1988)	-	-	+	-	-	●	-	+
Sitzman et al. (2023)	-	-	+	-	-	●	-	-
Peyvaste al.(2023)	+	-	+	+	+	+	-	+
Yi et al.(2021)	+	-	-	-	+	+	-	+
Park et al.(2022)	+	+	+	-	+	+	-	+
Hattori et al.(2024)	+	-	-	-	+	+	-	+
Dong et al.(2012)	+	+	+	+	-	-	+	+
Lignieres et al.(2024)	+	+	+	+	-	-	+	+
Trotter et al. (2025)	-	-	-	-	+	+	-	+

Domains:
D1: Bias due to confounding.
D2: Bias due to selection of participants.
D3: Bias in classification of interventions.
D4: Bias due to deviations from intended interventions.
D5: Bias due to missing data.
D6: Bias in measurement of outcomes.
D7: Bias in selection of the reported result.

Judgement
● Critical
● Serious
- Moderate
+ Low
? No information

Figure 3. The study by Adamson et al. (2026) was rated as having a high risk of bias, while the remaining studies were judged to have a moderate risk of bias.

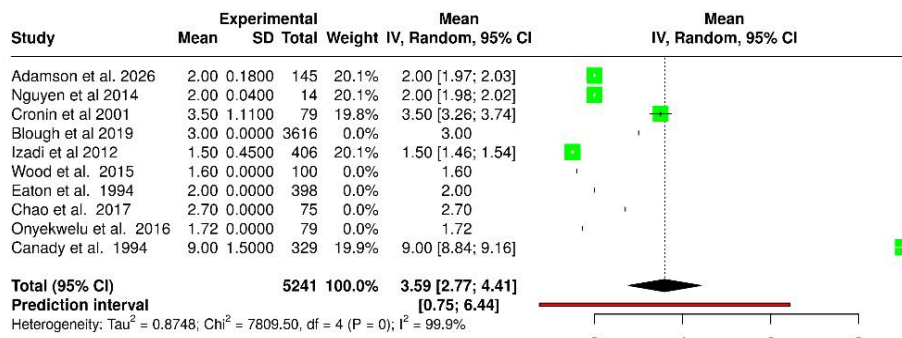


Figure 4. The sources of heterogeneity a subgroup analysis based on study design (prospective vs retrospective) was performed.

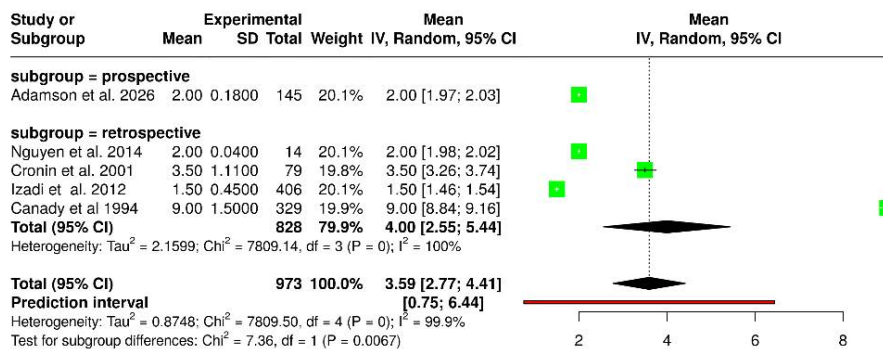


Figure 5. The pooled mean length of hospital stay in retrospective studies was 4.00 days (95% CI: 2.55–5.44).

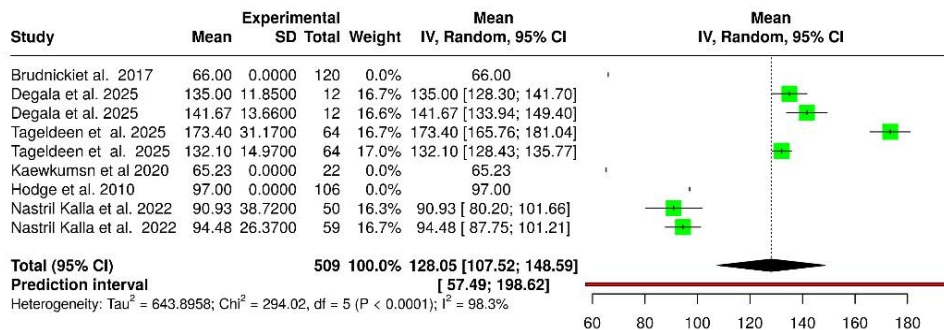


Figure 6. The pooled mean duration of surgery was 128.05 minutes (95% CI: 107.52–148.59).

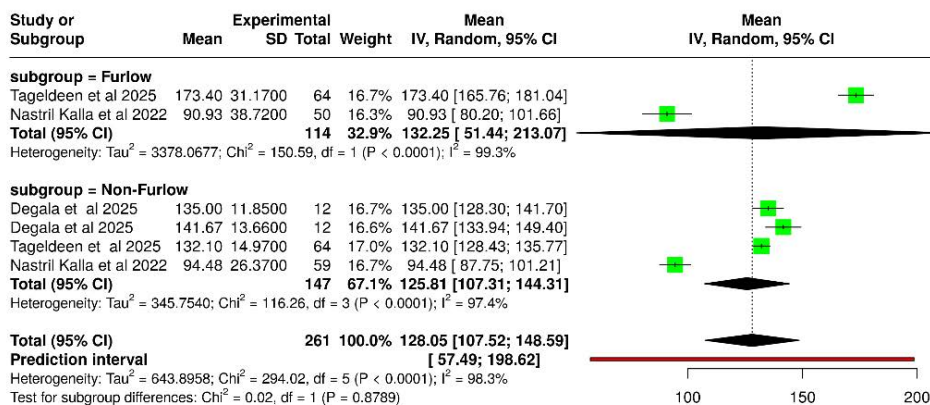


Figure 7. Subgroup analysis based on surgical technique was performed.

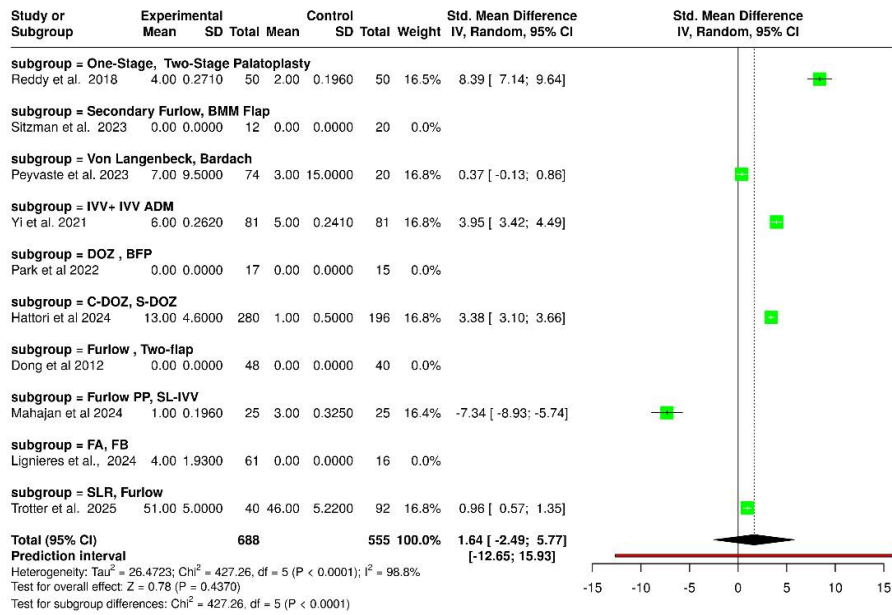


Figure 8. The pooled standardized mean difference (SMD) was 1.64 (95% CI: -2.49 to 5.57, $p = 0.437$), indicating no statistically significant difference in fistula incidence between the compared palatoplasty techniques.

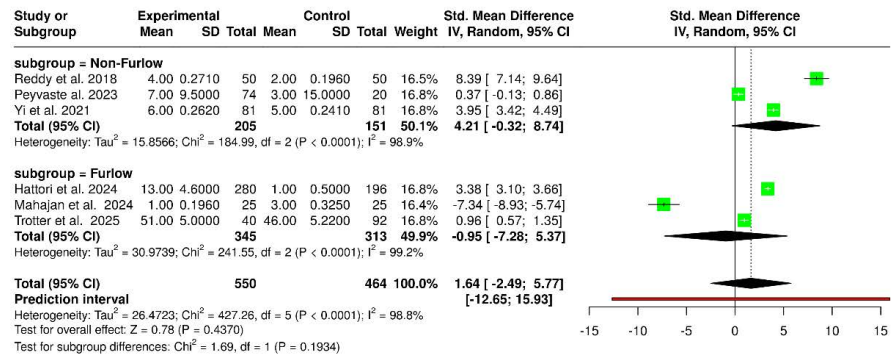


Figure 9. Subgroup analysis based on surgical technique was performed.

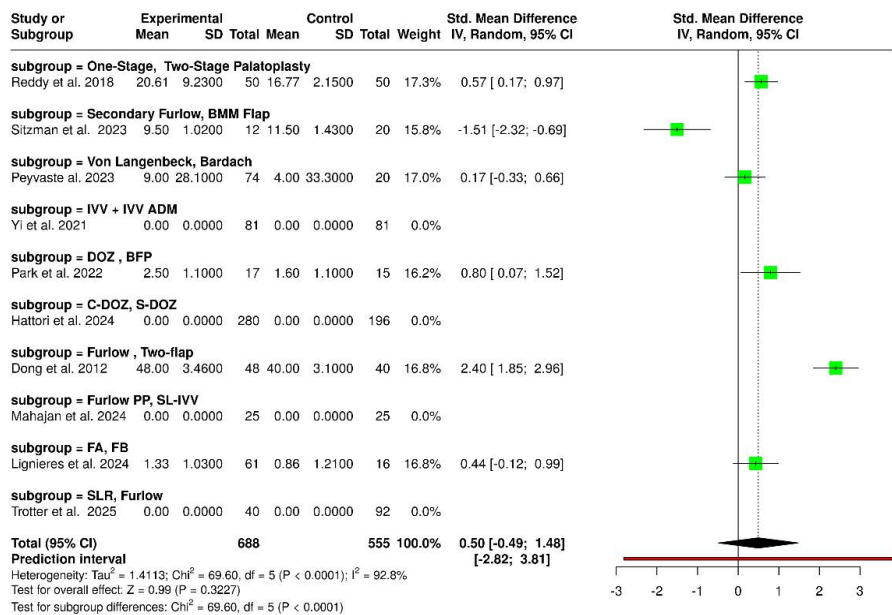


Figure 10. The pooled standardized mean difference (SMD) was 0.50 (95% CI: -0.49 to 1.48, $p = 0.3227$), showing no statistically significant difference in hypernasality between the compared palatoplasty techniques.

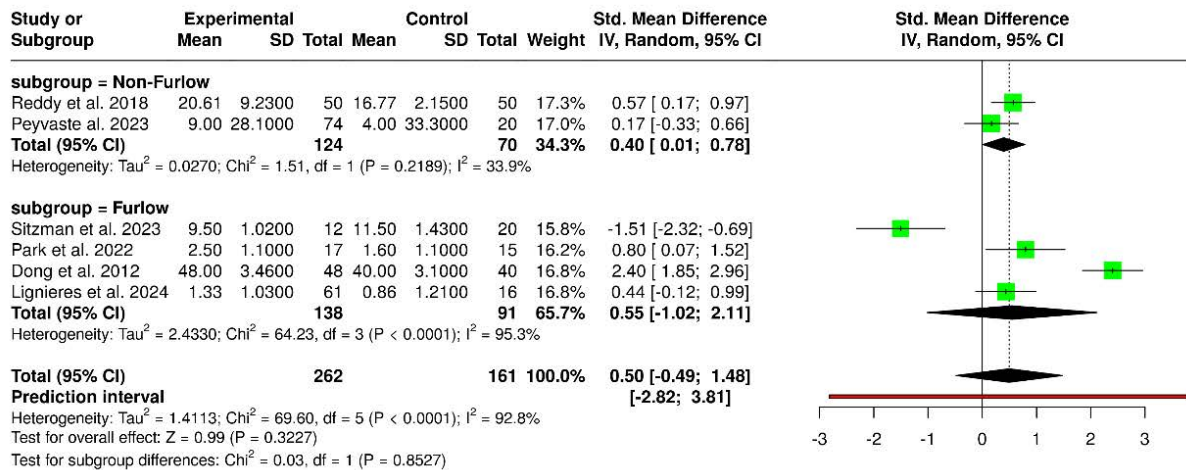


Figure 11. The test for subgroup differences was not statistically significant ($p = 0.8527$).

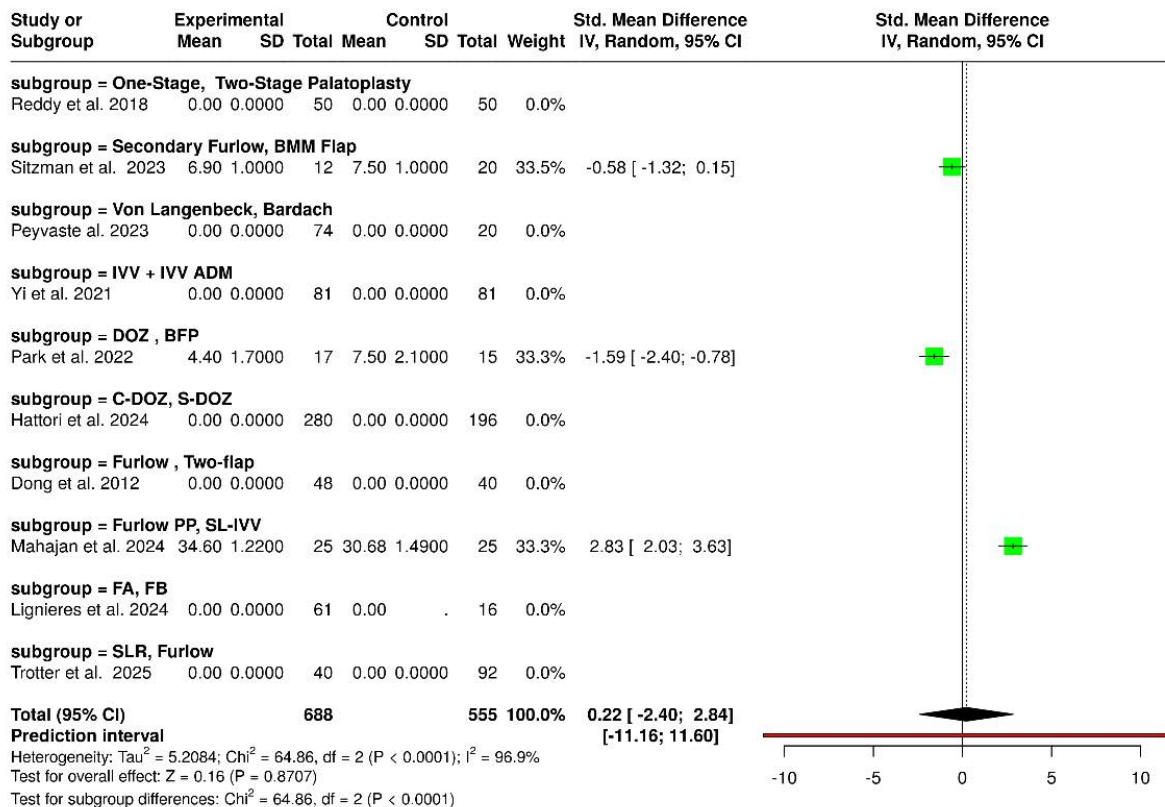


Figure 12. The pooled standardized mean difference (SMD) was 0.22 (95% CI: -2.40 to 2.84, $p = 0.8707$), indicating no statistically significant difference in soft palate length between the compared palatoplasty techniques.

Heterogeneity was high: $\tau^2 = 643.8958$, $\chi^2 = 294.02$, $df = 5$, $p < 0.0001$, and $I^2 = 98.3\%$, suggesting considerable differences among the included studies.

The largest contribution to the pooled estimate was provided by the studies Tageldeen et al. (2025) (weight = 17.0% and 16.7%) and Degala et al. (2025) — (weight 16.7% и 16.6%).

Subgroup analysis based on surgical technique was performed (Figure 7). Studies were categorized into Furlow-based and non-Furlow techniques. The pooled operative time for the Furlow subgroup was 132.25 minutes (95% CI: 51.44–213.07), while for the non-Furlow subgroups it was 125.85 minutes (95% CI: 107.31–144.31). High heterogeneity persisted within both

subgroups ($I^2 > 95\%$). The test for subgroup differences was not statistically significant ($p = 0.8789$), indicating no significant difference between groups.

Intraoperative Bleeding:

Five studies reported data on intraoperative bleeding, with a total of 3767 patients included. Of these, two were retrospective studies, two were prospective cohort studies and one was a prospective clinical study (Table 3).

The lowest incidence of bleeding was observed in large retrospective studies with larger sample sizes

Zhang et al. (2014), — 2 cases out of 2,100 patients, Mahajan

Table 2. Duration of Surgery.

Author	year	design	surgical technique	number. patients	Time	
					minutes	SD
Brudnicki et al. [36]	2017	retrospective	one-stage primary palatoplasty	120	66	ND
Degala et al. [37]	2025	prospective, comparative, observational study	Bardach's two-flap palatoplasty	12	135	11.85
Degala et al. [37],	2025	prospective, comparative, observational study	modified two-flap palatoplasty	12	141.67	13.66
Tageldeen et al. [38]	2025	randomized clinical trial	Furrow double-opposing Z-plasty	64	173.4	31.17
Tageldeen et al. [38]	2025	randomized clinical trial	rotational flap palatoplasty.	64	132.1	14.97
Kaewkumsn et al.[39]	2020	ND	two-flap palatoplasty	22	65.23	ND
Hodge et al. [40]	2010	ND	Sommerlad technique	106	97	ND
Nastril Kalla et al. [41]	2022	prospective study	Z-plasty Furrow	50	90.93	38.72
Nastril Kalla et al. [41]	2022	prospective study	buccal fat pad coverage	59	94.48	26.37

Note: ND — not determined; SD- standard deviation.

Table 3. Intraoperative Bleeding.

Author	year	study design	surgical technique	number. patients	intraoperative bleeding cases (n)
Schonnmeyr et al. [43],	2016	retrospective study	Primary cleft palate repair	1408	25
Mahajan et al. [44]	2024	prospective cohort study	Furrow's palatoplasty, straight-line intravelar veloplasty	50	3
Ruslin et al. [45]	2019	prospective study	von Langenbeck, Veau-Kilner technique	150	14
Zhang et al. [46]	2014	retrospective study	von Langenbeck, Veau/Wardill/Kilner, and Furrow techniques	2100	2
Kim et al. [42]	2018	prospective clinical study	undergoing Furrow's double opposing Z-palatoplasty	59	59

Table 4. Airway Obstruction.

Author	year	type of the study	surgical technique	number. patients	airway obstruction cases (n)
Pena et al. [47]	2000	retrospective study	ND	87	2
Sullivan et al. [48]	2024	retrospective study	von Langenbeck palatoplasty, Veau-Wardill-Kilner VY-pushback, Furrow double opposing Z-plasty	386	55
Blough et al. [49]	2018	prospective cohort study	ND	3,616	72
Adenek et al.[50]	2011	prospective cohort study	ND	116	6
Antony et al. [51]	2002	retrospective study	ND	247	14
Cohen et al. [52]	2024	retrospective study	two-flap palatoplasty, Furrow double-opposing Z-plasty	66	12

Note: ND — not determined.

Table 5. Postoperative Bleeding.

Author	year	study design	surgical technique	total number of surgeries	postoperative bleeding case(n)
Isch et al. [53]	2025	retrospective analyses	ND	13161	97
Park et al. [54]	2016	retrospective analyses	ND	338	0
Adesina et al. [55]	2016	prospective cohort study	ND	30	2
Rossel-Perry et al. [18]	2013	retrospective analyses	ND	1262	70
Mahajan et al. [44]	2024	prospective cohort study	Furlow's, straight-line intravelar veloplasty	50	3

Note: ND — not determined.

Table 6. Wound Dehiscence after operation.

Author	year	study design	surgical technique	total number of surgeries	patients with wound dehiscence (n)
Deshpande et al. [56]	2014	retrospective study	ND	709	17
Bosi et al. [57]	2016	prospective study	von Langenbeck technique	60	3
Ruslin et al. [45]	2019	prospective study	Von Langenbeck, VeauKilner	150	1
Paine et al. [58]	2016	retrospective study	ND	751	4

Note: ND — not determined.

Table 7. Characteristics of studies evaluating Eustachian tube function after palatoplasty.

Author	year	study design	surgical technique	number. patients	outcome
Kochar et al. [59]	2021	observational cohort study	ND	63	high prevalence of otitis media with effusion in these patients.
Prosak et al. [60]	2025	retrospective cohort	Furlow, IVV repair	73	patients may still need the same amount of time for resolution of their eustachian tube dysfunction.
Nasomtrug et al. [61]	2016	retrospective	2-flap palatoplasty	82	the median recovery time for Eustachian tube function after primary 2-flap palatoplasty with intravelarveloplasty at Srinagarind Hospital was 37.5 months. Eustachian tube
Moore et al. [62]	1988	retrospective	von Langenbeck technique, Wardill-Kilner	196	19 patient's otitis were detected

Note: ND — not determined.

et al. (2024), — 3 cases out of 50 patients. A moderate incidence of bleeding was reported in the following studies: Schonmeyr et al. (2016), — 25 cases out of 1,408 patients, Ruslin et al. (2019), — 14 cases out of 150 patients.

The highest number of bleeding episodes was recorded in the study by Kim et al. (2018), Intraoperative bleeding was reported in all 59 patients; however, it was minor and easily controlled, and no difficulties in achieving hemostasis were encountered [42].

The following surgical techniques were included: Primary cleft palate repair, Furlow's palatoplasty, straight-line intravelar veloplasty, von Langenbeck palatoplasty, Veau–Kilner palatoplasty, Wardill–Kilner pushback palatoplasty, undergoing Furlow's double opposing Z-palatoplasty.

Airway Obstruction:

The table provides an overview of the included studies that evaluated postoperative respiratory complications (airway obstruction) following palatoplasty. The table presents the following information: author and study title, year of publication, study design, number of patients, type of surgical intervention (if specified), and the number of reported cases of airway obstruction.

Among the six included studies, four were retrospective, two were prospective cohort studies. The reported incidence of airway obstruction ranged from 2 to 72 cases per study (Table 4).

Table 8. Characteristics of studies evaluating Outcomes of Palatoplasty.

Study	Design	Control technique(C)	Test technique(T)	Fistula (C), Mean ± SD	Fistula (T), Mean ± SD	Hypernasality (C), Mean ± SD	Hypernasality (T), Mean ± SD	Soft palate length (C), Mean ± SD	Soft palate length (T), Mean ± SD
Reddy et al. [63]	rct	one stage palatoplasty	two-stage palatoplasty	4 ± 0.27	2 ± 0.19	20.61 ± 9.23	16.77 ± 2.15	ND	ND
Sitzman et al. [64]	retrospective cohort study	secondary Furlow palatoplasty	buccal myomucosal flap	ND	ND	9.5 ± 1.02	11.5 ± 1.43	6.9 ± 1.0	7.5 ± 1.0
Peyvaste et al. [65]	cross-sectional analytical study	von Langenbeck palatoplasty	Bardach Palatoplasty	7 ± 9.5	3 ± 15	9 ± 28.1	4 ± 33.3	ND	ND
Yi et al. [66]	retrospective study	primary palatoplasty with conventional intravelar veloplasty	primary palatoplasty with adm	6 ± 0.2	5 ± 0.24	ND	ND	ND	ND
Park et al. [67]	retrospective study	DOZ palatoplasty	BFP palatoplasty	ND	ND	2.5 ± 1.1	1.6 ± 1.1	4.4 ± 1.7	7.5 ± 2.1
Hattori et al. [68]	retrospective study	DOZ palatoplasty	small-DOZ	13 ± 4.6	1 ± 0.5	ND	ND	ND	ND
Dong et al. [69]	retrospective study	Furlow palatoplasty	two-flap palatoplasty	ND	ND	48 ± 3.46	40 ± 3.1	ND	ND
Mahajan et al. [44]	prospective cohort study	Furlow palatoplasty	straight line intravelar palatoplasty	1 ± 0.19	3.0 ± 0.32	ND	ND	34.6 ± 1.22	30.6 ± 1.49
Lignieres et al. [70]	retrospective study	Furlow palatoplasty	FB palatoplasty	4 ± 1.93	ND	1.33 ± 1.03	0.86 ± 1.21	ND	ND
Trotter et al. [71]	retrospective cohort study	straight line repair	Furlow Repair palatoplasty	51 ± 5	46 ± 5.22	ND	ND	ND	ND

Note: In observation studies, the designation of control (C) and test (T) group was based on the comparison reported by the original authors, where the control group represents the standard or commonly used technique, and the test group represents the alternative or modified approach; SD- standard deviation; RCT— randomized controlled trial; ND — not determined; BFP- Pedicled buccal fat pad flap; DOZ- Double Opposing Z-plasty; FB — Furlow palatoplasty with buccal flaps.

Postoperative Complications.

Postoperative Bleeding:

The table summarizes the included studies that evaluated postoperative bleeding following cleft palate repair. A total of five studies were included in this review, of which three were retrospective analyses and two were a prospective cohort study. The number of patients ranged from 30 to 13161 across the studies, while the reported incidence of postoperative bleeding varied from 0 to 97 cases (Table 5).

In the study by Isch et al. (2025) postoperative bleeding was recorded in 97 of 13161 patients.

Rossell-Perry et al. (2013) reported postoperative bleeding in 70 of 1262 children.

In the study by Park et al. (2016), which included 338 children, no cases of postoperative bleeding were reported. However, in

most of the included studies, the authors did not specify the specific surgical technique used for palatoplasty. The exception is the work of Mahajan et al. (2024), which used Furlow's Z-plasty and underwent straight-line intravelar veloplasty techniques. In this study, 3 of 50 children experienced postoperative bleeding.

Wound Dehiscence:

The table provides an overview of the included studies that evaluated wound dehiscence following palatoplasty. Of the four included studies, two were retrospective (n = 709 and 751 procedures) and two were prospective (n = 60 and 150). The most commonly employed surgical techniques were the von Langenbeck technique with intravelar veloplasty (Table 6).

In a retrospective study by Deshpande et al. (2014), involving 709 patients, wound dehiscence was detected in 17 cases. Bosi

et al. (2016) reported wound dehiscence in 3 of 60 patients who underwent surgery using the von Langenbeck technique. In a study by Ruslin et al. (2019), which included 150 patients operated on using the von Langenbeck and Veau–Kilner techniques, postoperative wound dehiscence was observed in 1 patient. In a retrospective analysis presented by Paine et al. (2016), wound dehiscence was recorded in 4 patients out of 751. These findings suggest that the risk of wound dehiscence following palatoplasty may depend on both the surgical technique used and the size and characteristics of the study population.

Eustachian Tube Dysfunction:

The table summarizes the included studies that evaluated Eustachian tube function and the incidence of otitis media following palatoplasty. Across the four included studies (N = 63–196), a high incidence of otitis media with effusion was reported, along with prolonged recovery of Eustachian tube function, extending up to 37.5 months.

The table presents the main characteristics of four clinical studies assessing Eustachian tube function in patients with cleft palate and the effect of different palatoplasty techniques on its recovery. One prospective observational cohort study and three retrospective studies were included (Table 7).

The study by Kochar et al. (2021) revealed a high prevalence of exudative otitis media in patients. Prosak et al. (2025) analyzed 73 patients who underwent palatoplasty using Furlow and intravelar veloplasty techniques and found that the recovery time of eustachian tube function was similar regardless of the surgical method used. In a study by Nasomtrug et al. (2016), the 2-flap palatoplasty technique with intravelar veloplasty was used. The authors found that the median time for recovery of Eustachian tube function after primary surgery was 37.5 months. In the study by Moore et al. (1988), the von Langenbeck and Wardill–Kilner techniques were used. During follow-up, otitis media was detected in 19 patients.

Outcomes of Palatoplasty:

Ten studies were included in the meta-analysis: one randomized controlled trial (RCT), seven retrospective studies, one prospective cohort study, and one cross-sectional analytical study. (Table 8).

The included studies assessed the outcomes of various surgical techniques, including one-stage and two-stage palatoplasty, secondary Furlow, buccal myomucosal flap, von Langenbeck, Bardach, primary palatoplasty with conventional intravelar veloplasty, primary palatoplasty with ADM, DOZ, BFP, Furlow palatoplasty, two-flap palatoplasty, and straight-line intravelar veloplasty.

Fistula Formation:

The analysis included 10 studies evaluating the incidence of oronasal fistula formation following different palatoplasty techniques. The included studies varied in design (randomized controlled trials, prospective cohort studies, and retrospective cohort studies), surgical techniques, and patient characteristics.

The analysis of oronasal fistula incidence demonstrated extremely high heterogeneity among studies ($I^2 = 98.8\%$, $p < 0.00001$), indicating substantial differences in study design,

surgical protocols, patient characteristics, and outcome assessment criteria.

The pooled standardized mean difference (SMD) was 1.64 (95% CI: -2.49 to 5.57 , $p = 0.437$), indicating no statistically significant difference in fistula incidence between the compared palatoplasty techniques (Figure 8).

The wide prediction interval (12.65 to 15.93) indicates considerable variability in the expected outcomes in future studies and highlights the instability and heterogeneity of the available data. The incidence of fistula formation in individual studies ranged from 0 to 13 cases, which may reflect differences in several factors, including the surgical techniques used (Furlow, Bardach, von Langenbeck, Sommerlad, DOZ), sample size, criteria for fistula diagnosis, surgeon experience, and postoperative management protocols.

Subgroup analysis based on surgical technique was performed (Figure 9). Studies were categorized into Furlow and non-Furlow groups. The pooled effect size in the non-Furlow group was 4.21 (95% CI: -0.32 to 8.74), while in the Furlow group it was -0.95 (95% CI: -7.28 to 5.37). High heterogeneity was observed in both subgroups ($I^2 > 98\%$). The test for subgroup differences was not statistically significant ($p = 0.1934$), indicating no significant difference between groups.

Hypernasality:

The meta-analysis included four studies evaluating hypernasality following different palatoplasty techniques. The analysis of hypernasality demonstrated very high heterogeneity among studies ($I^2 = 92.8\%$, $p < 0.0001$), indicating substantial differences in speech assessment methods, patient characteristics, and surgical techniques.

The pooled standardized mean difference (SMD) was 0.50 (95% CI: -0.49 to 1.48 , $p = 0.3227$), showing no statistically significant difference in hypernasality between the compared palatoplasty techniques (Figure 10).

The wide prediction interval (-2.82 to 3.81) highlights considerable variability in potential true effects in future studies and underscores the instability and heterogeneity of the available data.

The analysis showed that none of the compared surgical techniques demonstrated a clear advantage in reducing hypernasality. However, due to substantial heterogeneity among the studies, the results should be interpreted with caution. Standardized speech assessment methods and large randomized clinical trials are required to obtain more reliable conclusions. Subgroup analysis based on surgical technique (Furlow vs non-Furlow) was performed. The pooled effect size in the non-Furlow subgroup was 0.40 (95% CI: 0.01 – 0.78), while in the Furlow subgroup it was 0.55 (95% CI: -1.02 to 2.11). High heterogeneity was observed in the Furlow subgroup ($I^2 = 95.3\%$), whereas the non-Furlow subgroup showed lower heterogeneity ($I^2 = 33.9\%$). The test for subgroup differences was not statistically significant ($p = 0.8527$) (Figure 11).

Soft Palate Length:

The analysis of soft palate length demonstrated very high heterogeneity among studies ($I^2 = 96.9\%$, $p < 0.0001$), reflecting substantial differences in speech assessment methods, patient

characteristics, and surgical approaches.

The pooled standardized mean difference (SMD) was 0.22 (95% CI: -2.40 to 2.84, $p = 0.8707$), indicating no statistically significant difference in soft palate length between the compared palatoplasty techniques (Figure 12).

The wide prediction interval (-11.16 to 11.60) highlights considerable variability in the potential true effect in future studies and underscores the instability and heterogeneity of the available data.

The meta-analysis showed that none of the surgical techniques demonstrated a proven advantage in increasing the length of the soft palate. However, due to substantial heterogeneity among the studies, the results should be interpreted with caution. Further well-designed prospective studies with standardized measurement methods are required to obtain more reliable conclusions.

Discussion.

Bleeding during surgery is one of the main complications of the intraoperative period, as stopping it requires considerable time on the part of the surgeon. The significance of this problem has been confirmed in studies by [42-45].

A higher incidence of postoperative bleeding was reported compared with other studies. The sample included 59 children, all of whom experienced bleeding; however, in all cases it was mild [42].

Intraoperative bleeding was reported in 25 of 1,408 patients (1.8%) who underwent primary cleft palate repair [43].

A direct association between a child's body weight and the risk of complications has been demonstrated, supporting the concept that low-weight infants are more vulnerable to surgical and anesthetic stress. The immaturity of physiological systems, limited compensatory capacity, and anatomical characteristics of the respiratory tract may account for the higher complication rates in this patient group [72].

While intraoperative complications, particularly bleeding, have a direct impact on the course of surgery, their contribution to the length of postoperative hospital stay is equally important. In this regard, a meta-analysis was conducted to assess the average length of hospitalisation after surgical treatment of cleft lip and palate [26-32].

The meta-analysis included 9 studies with a total of 5,241 participants and a random-effects model was used to pool the data. The pooled mean length of hospital stay was 3.59 days (95% CI: 2.77-4.41). The wide prediction interval (0.75-6.43) indicates considerable variability in outcomes between individual studies [26-32].

The heterogeneity analysis demonstrated extremely high between-study variability ($I^2 = 99.9\%$, $\tau^2 = 0.8721$, $\chi^2 = 7809.50$, $df = 4$, $p < 0.001$), suggesting that differences in clinical protocols, patient characteristics, and postoperative management may substantially influence the length of hospital stay [26-32]. Although subgroup analysis suggested a statistically significant difference between prospective and retrospective studies, this result should be interpreted cautiously, as the prospective subgroup consisted of only one study. Therefore, the observed difference may not reflect a true effect of study design.

A significant indicator of the effectiveness of the operation

is the duration of the procedure itself. The results of the meta-analysis demonstrate significant variability in the duration of surgical intervention, which is confirmed by a wide range of mean values (from 65.23 to 173.40 minutes) and extremely high heterogeneity ($I^2 = 98.3\%$). Such variations are likely attributable to the heterogeneity of surgical techniques, the complexity of the cleft, the experience of the surgeon, and variations in the organisation of the surgical process across institutions [36-41].

The combined mean duration of the procedure (128.05 minutes) should be interpreted with caution. The wide prediction interval (57.49-198.62 minutes) indicates that the actual duration of the intervention in future studies may differ significantly from the average value obtained. This highlights the limited generalizability of the summary indicator in the absence of standardized surgical protocols [36-41].

High heterogeneity may also reflect differences in patient age, the presence of associated anomalies, additional surgical stages and variations in anesthetic management. Despite the substantial contribution of several large studies, further prospective and standardized research is required to more precisely evaluate factors influencing operative time in cleft lip and palate surgery [36-41]. Despite subgroup analysis, heterogeneity remained high, suggesting that additional factors beyond surgical technique – such as patient characteristics, cleft severity and perioperative protocols – may contribute to variability in operative time.

After surgery, bleeding, haematoma, swelling, airway obstruction, soft palate sagging, and oronasal fistula formation may also occur. Although palatal necrosis after palatoplasty in patients with cleft palate is a rare but clinically significant complication, existing data on its prevalence are limited, making it difficult to accurately assess the risk [73].

The literature describes various factors contributing to flap failure, including kinking or damage to the pedicle, anatomical features, excessive tension, vascular thrombosis, cleft type, surgical technique used, surgeon experience, infectious complications, and the patient's nutritional status. These factors confirm the need for careful preoperative assessment and individual planning for each operation [74].

Recent studies indicate that early cheiloplasty and palatoplasty (before 18 months) positively influence speech and facial skeletal development; however, interventions performed too early may adversely affect maxillary growth [75].

The analysis of fistula incidence revealed extremely high heterogeneity among studies ($I^2 = 98.8\%$, $p < 0.00001$), reflecting substantial differences in study design, surgical protocols, patient characteristics, and outcome assessment methods. The pooled standardized mean difference was $SMD = 1.64$ (95% CI: -2.49, 5.57; $p = 0.437$), indicating no statistically significant difference in the incidence of fistula formation between the compared techniques. The wide prediction interval (-12.65 to 15.93) highlights the considerable variability of the potential true effect and the instability of the available data. Subgroup analysis based on surgical technique (Furlow vs non-Furlow) did not demonstrate a statistically significant difference between groups ($p = 0.1934$). High heterogeneity persisted within both subgroups ($I^2 > 98\%$), indicating that factors other than surgical

technique likely contribute to variability in fistula formation.

The present meta-analysis evaluated hypernasality outcomes following different palatoplasty techniques. The pooled analysis did not demonstrate a statistically significant difference between the compared surgical approaches, suggesting that the choice of surgical technique alone may not be the main determinant of postoperative speech resonance outcomes.

However, a very high level of heterogeneity was observed among the included studies ($I^2 = 92.8\%$), indicating considerable variability in study design, speech assessment methods, patient characteristics and surgical protocols. Difference in the timing of surgery, cleft severity, surgeon experience and postoperative speech therapy may also contribute to variability in the reported outcomes. The wide prediction interval further reflects the uncertainty of the pooled estimate and indicates that future studies may report substantially different results. Therefore, these findings should be interpreted with caution. The non-Furlow subgroup demonstrated lower heterogeneity compared to the Furlow subgroup, suggesting more consistent outcomes across studies.

Furthermore, the analysis of soft palate length did not reveal a statistically significant difference between the compared palatoplasty techniques. This finding suggests that the choice of surgical technique alone may not substantially influence postoperative soft palate dimensions. However, this interpretation of these results is limited by the very high heterogeneity observed across the included studies ($I^2 = 96.9\%$). Variability in patient characteristics, cleft severity, surgical approaches and measurement methods may have contributed to the differences in reported outcomes.

Single-stage cleft palate repair involves closing the soft and hard palate at 1–2 years of age, reducing the number of operations but potentially affecting upper jaw growth. An alternative is a two-stage technique: first, the soft palate is closed at around 1 year of age, then the hard palate at around 4 years of age [76].

In cases of scarring or limited mobility of the patient's own tissues, additional regional flaps may be used to reconstruct the oral or nasal lining during double-opposing Z-plasty, including facial artery musculomucosal (FAMM) flaps, buccal myomucosal flaps, and buccal fat pad flaps [77].

Radical intravelar veloplasty involves almost complete mobilization and repositioning of the levator veli palatini, which restores the anatomical configuration of the muscle, improving soft palate function, and reduces the need for secondary surgery (successful speech: 81.9% vs. 49.5%; repeat interventions: 6.7% vs. 29%; ($p < 0.001$) without increasing postoperative morbidity [78].

Conclusion.

The results of the meta-analysis indicate that functional outcomes of palatoplasty primarily depend on the quality of surgical reconstruction, precise anatomical repositioning of the muscles, minimization of tissue tension, and the surgeon's experience. The choice of a specific technique has an indirect effect, and the effectiveness of the procedure should be evaluated comprehensively, considering the patient's individual characteristics and technical nuances.

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