

Optimizing Surgical Techniques in Female Aesthetic Surgery Through Systematic Evidence Synthesis

Ph.D. Thesis

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*“The good physician treats the disease; the great physician treats the patient who has
the disease.”*

— Sir William Osler

TABLE OF CONTENTS

1. LIST OF ABBREVIATIONS.....	5
2. STUDENT PROFILE.....	6
2.1. Vision and mission statement, specific goals.....	6
2.2. Scientometrics.....	6
2.3. Future plans.....	7
3. SUMMARY OF THE THESIS.....	8
4. GRAPHICAL ABSTRACT.....	9
5. INTRODUCTION.....	10
5.1. Overview of the topic.....	10
5.1.1. What is the topic?.....	10
5.1.2. What is the problem to solve?.....	11
5.1.3. What is the importance of the topic?.....	11
5.1.4. What would be the impact of our research results?.....	11
5.2. Labiaplasty: Techniques and Outcomes.....	12
5.3. Breast Surgery and Breastfeeding.....	13
5.4. Systematic Reviews and Meta-Analyses as Evidence Tools.....	14
6. OBJECTIVES.....	15
6.1. Study I. — Comprehensive Assessment of Labiaplasty Techniques and Tools: Satisfaction Rates and Risk Factors.....	15
6.2. Study II. — Effects of Breast Surgery on Breastfeeding: A Systematic Review and Meta-Analysis.....	15
7. METHODS.....	16
7.1. Study I.....	16
7.1.1. Methodology and Protocol.....	16
7.1.2. Eligibility Criteria.....	16
7.1.3. Information Sources and Search Strategy.....	16

7.1.4. Study Selection and Data Extraction.....	16
7.1.5. Risk of Bias and Quality of Evidence Assessment.....	17
7.1.6. Data Synthesis and Analysis.....	17
7.2. Study II.....	17
7.2.1. Methodology and Protocol.....	17
7.2.2. Eligibility Criteria.....	18
7.2.3. Information Sources and Search Strategy.....	18
7.2.4. Study Selection and Data Extraction.....	18
7.2.5. Risk of Bias and Quality of Evidence Assessment.....	18
7.2.6. Data Synthesis and Analysis.....	18
8. RESULTS.....	20
8.1. Study I: Comprehensive Assessment of Labiaplasty Techniques — Meta-Analysis.....	20
8.1.1. Study Search and Selection.....	20
8.1.2. Patient Characteristics.....	21
8.1.3. Patient Satisfaction.....	21
8.1.4. Complications.....	22
8.1.5. Risk of Bias Assessment.....	23
8.2. Study II: Effects of Breast Surgery on Breastfeeding — Systematic Review and Meta-Analysis.....	24
8.2.1. Study Search and Selection.....	24
8.2.2. Breast Augmentation Outcomes.....	25
8.2.3. Breast Reduction Outcomes.....	25
8.2.4. Nipple Repair Outcomes.....	26
8.2.5. Risk of Bias Assessment.....	26
9. DISCUSSION.....	28
9.1. Summary of Findings and International Comparisons.....	28
9.2. Strengths.....	32
9.3. Limitations.....	33

10. CONCLUSIONS.....	35
11. IMPLICATIONS FOR PRACTICE.....	36
12. IMPLICATIONS FOR RESEARCH.....	37
12.1. Methodology and Study Design.....	37
12.2. New Areas.....	37
13. IMPLICATIONS FOR POLICY MAKERS.....	38
14. FUTURE PERSPECTIVES.....	39
15. REFERENCES.....	40
16. BIBLIOGRAPHY.....	44
16.1. Publications Related to the Thesis.....	44
16.2. Publications not Related to the Thesis.....	44
17. ACKNOWLEDGEMENTS.....	45

1. LIST OF ABBREVIATIONS

ACOG American College of Obstetricians and Gynecologists

ASPS American Society of Plastic Surgeons

BMI Body Mass Index

CI Confidence Interval

CTM Centre for Translational Medicine

FDA U.S. Food and Drug Administration

IF Impact Factor

ISAPS International Society of Aesthetic Plastic Surgery

MINORS Methodological Index for Non-Randomized Studies

NAC Nipple-Areola Complex

PRISMA Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PROSPERO International Prospective Register of Systematic Reviews

RCT Randomized Controlled Trial

WHO World Health Organization

2. STUDENT PROFILE



2.1. Vision and mission statement, specific goals

My mission as a physician is to improve the safety, quality and patient-centred outcomes of female aesthetic and reconstructive surgery through rigorous, evidence-based synthesis of the existing literature. Working within the framework of translational medicine, I aim to bridge the gap between the rapidly growing clinical demand for female cosmetic surgical procedures and the often fragmented and low-quality evidence that guides them. My specific goal is to provide surgeons, patients and policy makers with reliable, quantitative answers regarding the satisfaction rates, complication profiles and functional consequences of labiaplasty and breast surgery, thereby supporting truly informed decision making.

The two systematic reviews and meta-analyses that form the backbone of this thesis address two clinically important yet under-investigated questions: which labiaplasty techniques and surgical tools offer the best balance of satisfaction and safety, and how different breast surgical procedures affect a woman's subsequent ability to breastfeed. My ambition is to translate these aggregated findings into practical recommendations that can be implemented in everyday clinical practice.

2.2. Scientometrics

Number of all publications	2
Cumulative impact factor (IF)	8.4
Average IF / publication	4.2
Ranking (SCImago): D1 / Q1 / Q2 / Q3 / Q4	2 / 0 / 0 / 0 / 0
Number of publications related to the thesis	2
Cumulative IF (thesis-related)	8.4

Average IF / publication (thesis-related)	4.2
Ranking (SCImago, thesis-related): D1 / Q1 / Q2 / Q3 / Q4	2 / 0 / 0 / 0 / 0
Number of citations on Google Scholar	27
Number of citations on MTMT (independent)	16
H-index	2

The detailed bibliography of the student can be found on pages [to be completed at submission].

2.3. Future plans

Building on the meta-analytical work presented here, my future research will focus on the standardisation of outcome reporting and surgical nomenclature in female aesthetic surgery, and on the design of prospective, multicentre studies with validated, patient-reported outcome measures. I intend to pursue technique optimisation for labiaplasty, in particular the refinement of vessel- and nerve-preserving approaches, and to investigate breast surgical strategies that maximise the preservation of lactation, so that women can make fully informed choices that align with their reproductive plans.

3. SUMMARY OF THE THESIS

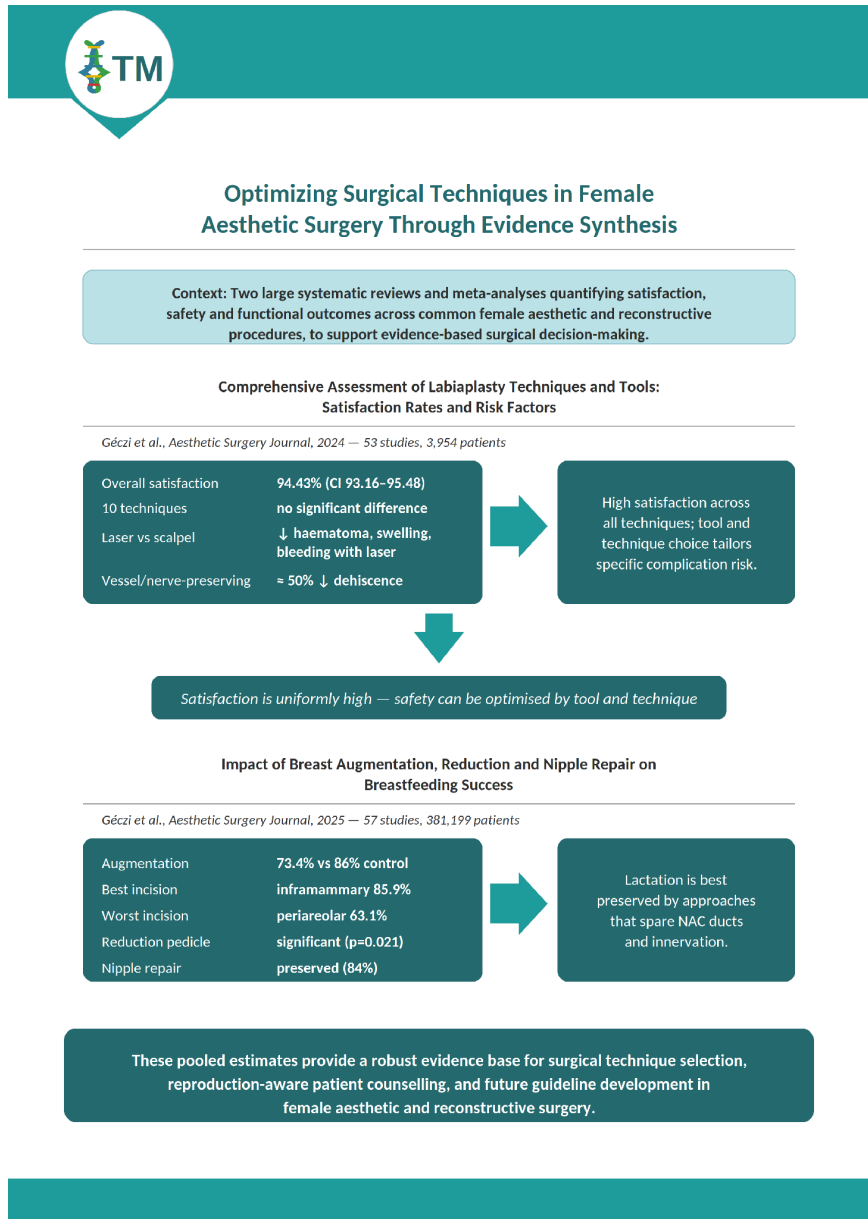
Female aesthetic and reconstructive surgery has expanded rapidly over the past two decades, yet the evidence base supporting many of its most common procedures remains heterogeneous and of variable quality. This thesis brings together two large systematic reviews and meta-analyses that quantitatively address two distinct but conceptually linked questions within this field.

Study I comprehensively assessed labiaplasty techniques and surgical tools, focusing on satisfaction rates and the risk factors for complications. Drawing on 53 studies and 3,954 patients, the overall pooled patient satisfaction reached 94.43% (95% CI: 93.16%–95.48%), with no statistically significant difference between the ten surgical techniques analysed. Complication rates were generally low; notably, laser instruments were associated with significantly lower rates of haematoma, swelling and bleeding than scalpel, while vessel- and nerve-preserving wedge resection approximately halved the rate of wound dehiscence compared with the standard wedge technique.

Study II examined the effects of breast surgery on breastfeeding through a systematic review and meta-analysis of 57 studies comprising 381,199 patients across breast augmentation, breast reduction and nipple repair. Breastfeeding success after augmentation (73.4%) was lower than in non-augmented controls (86%), although the difference did not reach significance; the inframammary incision performed best (85.9%) and the periareolar incision worst (63.1%). Among reduction techniques, outcomes differed significantly ($p=0.021$), with pedicles that better preserve the neurovascular and ductal supply of the nipple-areola complex yielding superior lactation. Nipple repair did not substantially reduce breastfeeding success (84%).

Taken together, these studies provide robust, pooled estimates that can inform surgical decision making, patient counselling and the design of future prospective research, and they exemplify the translational medicine approach of converting fragmented clinical evidence into actionable knowledge.

4. GRAPHICAL ABSTRACT



Graphical abstract incorporating both studies of the thesis.

5. INTRODUCTION

5.1. Overview of the topic

5.1.1. What is the topic?

This thesis addresses two prominent areas of female aesthetic and reconstructive surgery: labiaplasty — the surgical reduction of the labia minora — and breast surgery in its principal forms (augmentation, reduction and nipple correction), with particular attention to its consequences for breastfeeding. Both topics sit at the intersection of cosmetic intent and functional outcome, and both have seen a marked increase in demand worldwide. According to the International Society of Aesthetic Plastic Surgery (ISAPS), genital and breast procedures consistently rank among the most frequently performed aesthetic surgical interventions.^{10,11}

The growth in demand for these procedures has been documented across successive international surveys, with female genital cosmetic surgery and breast procedures both showing year-on-year increases.^{10,11,16} This trend has been attributed to a combination of greater social acceptance, increased patient awareness, the influence of media and shifting cultural norms regarding body image.⁹ As volumes rise, the responsibility to ensure that surgical decisions are grounded in sound, quantitative evidence becomes ever more pressing. It is precisely this responsibility to match a rapidly expanding clinical practice with an equally robust evidence base that motivates the present thesis and situates it firmly within the translational medicine paradigm.^{21,22}

Labiaplasty has become one of the fastest-growing aesthetic procedures, driven by a combination of functional complaints and aesthetic preferences.⁹ A wide variety of surgical techniques has been described, including edge (trim) resection, wedge resection and its vessel-preserving variants, deepithelialisation, composite reduction and the butterfly technique, and these may be performed with different tools, most commonly scalpel or laser.^{8,12} Breast surgery, meanwhile, encompasses procedures that may directly affect the glandular tissue, ductal system and innervation of the nipple-areola complex (NAC), with potential implications for a woman's subsequent ability to breastfeed.^{6,7}

5.1.2. What is the problem to solve?

Despite the high and rising volume of these procedures, the evidence guiding them is fragmented. For labiaplasty, the literature consists overwhelmingly of single-centre case series describing individual techniques, making direct comparison of satisfaction and complication rates between techniques and tools difficult.²⁸ No consensus exists on which approach offers the optimal balance between aesthetic satisfaction and surgical safety. For breast surgery, women of reproductive age are frequently counselled with limited, conflicting data on whether and how a given procedure will compromise future lactation.^{6,7,8} The central problem this thesis seeks to solve is therefore the absence of robust, pooled, quantitative estimates that synthesise the scattered evidence into a form usable for clinical decision making.

5.1.3. What is the importance of the topic?

These questions matter because they directly affect patient safety, satisfaction and reproductive autonomy. Labiaplasty is performed across a wide age range, including young women, and complications such as dehiscence, haematoma and infection carry both physical and psychological consequences.⁷ Breastfeeding, in turn, confers well-established benefits for infant and maternal health and is actively promoted by the World Health Organization. If a surgical decision needlessly impairs a woman's ability to breastfeed, the public-health implications extend well beyond the individual patient. Reliable evidence on these outcomes is essential for valid informed consent, a principle emphasised by professional bodies including ACOG and the FDA.⁶

5.1.4. What would be the impact of our research results?

By providing the most comprehensive pooled estimates available to date, the results of this thesis can directly inform surgical technique selection, instrument choice and preoperative counselling. Demonstrating that satisfaction is uniformly high across labiaplasty techniques while specific tools and vessel-preserving modifications reduce particular complications allows surgeons to tailor their approach to a patient's risk profile. Quantifying the differential effect of breast surgical techniques on lactation enables genuinely informed, reproduction-aware decision making. Beyond direct clinical use, these analyses highlight the methodological weaknesses of the current literature and thereby set the agenda for future prospective research.^{21,22}

5.2. Labiaplasty: Techniques and Outcomes

Labiaplasty refers to the surgical reduction of hypertrophic or asymmetric labia minora. Indications reported in the literature are heterogeneous and frequently overlap; the most common include aesthetic dissatisfaction, discomfort in clothing, discomfort during sports and sexual activity, hygiene problems, recurrent infections and sexual dysfunction.^{9,13} The absence of a universally accepted definition of labial hypertrophy contributes to variability in indications and in reported outcomes; classification systems such as that proposed by Motakef and colleagues have attempted to standardise the description of labial protrusion.¹

Numerous surgical techniques have been developed. The edge (trim) resection removes the free margin of the labium; wedge resection excises a V-shaped segment and preserves the natural labial edge, with vessel- and nerve-preserving modifications designed to maintain blood supply and sensation; deepithelialisation removes only the epithelial surface while preserving the underlying tissue; composite reduction combines elements of several approaches; and additional techniques include the butterfly technique, Z-plasty, W-shaped resection and radiofrequency- or laser-assisted methods.^{8,12,14} These procedures may be performed using a scalpel or a laser, and the choice of tool has been hypothesised to influence thermal injury, bleeding and healing.² Earlier reviews, including those by Oranges and by Escandón and colleagues, summarised these techniques but were limited in their ability to provide pooled quantitative comparisons of satisfaction and complications.²⁸ A comprehensive meta-analysis that simultaneously compares techniques and tools across satisfaction and the full spectrum of complications has therefore been lacking.

The reported outcomes of labiaplasty fall into two broad domains: patient satisfaction and postoperative complications. Satisfaction is the dominant outcome measure in the field, reflecting the predominantly elective and quality-of-life-oriented nature of the procedure, yet it is measured inconsistently across studies, ranging from simple binary questions to validated questionnaires.¹⁵ Complications, although individually uncommon, span a clinically meaningful spectrum that includes haematoma, wound dehiscence, postoperative swelling, bleeding and infection. Wound dehiscence is of particular concern because it may prolong healing, necessitate revision and adversely

affect both the aesthetic and functional result. The relationship between these complications and the underlying technique — for example, the extent to which a procedure preserves the blood supply and innervation of the labial tissue — and the surgical tool, with the laser's coagulative properties potentially reducing bleeding-related events, remained insufficiently quantified prior to this work.^{7,14}

5.3. Breast Surgery and Breastfeeding

Breastfeeding provides extensively documented short- and long-term health benefits for both infant and mother and is recommended by major paediatric and public-health organisations.⁶ At the same time, breast surgery is among the most commonly performed aesthetic and reconstructive procedures in women of reproductive age.^{10,11} The three principal categories — breast augmentation, breast reduction and nipple correction — differ in the extent to which they disturb the glandular tissue, ductal architecture and innervation of the NAC, and consequently in their potential to impair lactation.

In breast augmentation, the surgical incision (inframammary, periareolar or axillary) and the plane of implant placement determine the degree of disruption to ducts and to NAC innervation. Periareolar approaches, which traverse the breast tissue near the areola, have been suspected of more frequently compromising lactation, whereas inframammary approaches may better preserve ductal continuity. In breast reduction, the choice of pedicle determines which portion of the glandular and neurovascular supply to the NAC is preserved; techniques that maintain robust ductal and neurovascular connections to the nipple are expected to better preserve lactational capacity. Nipple correction procedures, performed for example for inverted nipples, may divide lactiferous ducts and thereby threaten breastfeeding. Existing reviews have addressed implants or individual procedures in isolation, leaving a need for a comprehensive synthesis spanning all three categories.^{6,7,8}

Several earlier meta-analyses have examined the relationship between breast implants and breastfeeding specifically. Chen and colleagues, Cheng and colleagues, and Schiff and colleagues each pooled comparative data and reported reductions in breastfeeding rates among women with implants, although their conclusions were tempered by the heterogeneity and observational nature of the included studies.^{28,29,30} However, these

analyses were largely confined to augmentation and did not provide an integrated picture across augmentation, reduction and nipple correction, nor did they consistently resolve outcomes by incision or pedicle type. The physiological plausibility of a technique-dependent effect is strong: sensory innervation of the nipple-areola complex, which is essential to the neuroendocrine let-down reflex, can be disrupted by certain incisions and pedicle designs, and the lactiferous ducts themselves may be transected.^{31,32} A synthesis that resolves outcomes at the level of surgical technique is therefore essential to translate this physiological understanding into clinical guidance.

5.4. Systematic Reviews and Meta-Analyses as Evidence Tools

Systematic reviews and meta-analyses sit at the apex of the hierarchy of evidence because they apply explicit, reproducible methods to identify, appraise and quantitatively combine all relevant studies addressing a focused question. When primary evidence consists predominantly of small, heterogeneous, non-randomised studies — as is the case for both labiaplasty and breast surgery — meta-analysis offers a means of increasing statistical power, generating pooled effect estimates and formally examining heterogeneity.¹⁷ Both studies in this thesis were conducted in accordance with the Cochrane Handbook for Systematic Reviews of Interventions and reported following the PRISMA 2020 statement, and both were prospectively registered to minimise bias.³⁴

This methodological rigour reflects the philosophy of translational medicine, which seeks to accelerate the cycle by which fragmented observations are transformed into validated, implementable knowledge.^{21,22} By pooling existing data, the present analyses extract maximum value from work already performed while clearly delineating the limitations that future prospective studies must address.

6. OBJECTIVES

The overarching objective of this thesis is to provide robust, quantitative evidence to guide clinical decision making in two common domains of female aesthetic and reconstructive surgery. Two specific studies were designed to meet this aim.

6.1. Study I. — Comprehensive Assessment of Labiaplasty Techniques and Tools: Satisfaction Rates and Risk Factors

The objectives of Study I were:

- To estimate the overall pooled patient satisfaction rate following labiaplasty.
- To compare satisfaction rates between the different surgical techniques (edge resection, wedge resection and its vessel-preserving variants, deepithelialisation, composite reduction, butterfly, Z-plasty, W-shaped resection, radiofrequency) and between the two principal surgical tools (scalpel versus laser).
- To quantify the pooled rates of the principal complications — haematoma, dehiscence, swelling, bleeding, infection and total complications — and to identify technique- and tool-related risk factors for these complications.

6.2. Study II. — Effects of Breast Surgery on Breastfeeding: A Systematic Review and Meta-Analysis

The objectives of Study II were:

- To determine the pooled breastfeeding success rate following the three principal categories of breast surgery: augmentation, reduction and nipple repair.
- To compare breastfeeding outcomes between different surgical approaches within each category, in particular incision type in augmentation and pedicle type in reduction.
- To contextualise these findings against control (non-operated) populations and against existing clinical guidelines, in order to inform reproduction-aware patient counselling.

7. METHODS

7.1. Study I.

7.1.1. Methodology and Protocol

Study I was designed and conducted as a systematic review and meta-analysis in accordance with the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions (Version 6.3) and was reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement.³⁴ The review protocol was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD42022380481. Prospective registration and adherence to established reporting standards were employed to minimise the risk of reporting and selection bias.

7.1.2. Eligibility Criteria

Studies were eligible for inclusion if they reported on patients undergoing labiaplasty (reduction of the labia minora) and provided extractable data on patient satisfaction and/or postoperative complications according to surgical technique and/or surgical tool. Studies reporting on any of the recognised techniques (edge resection, wedge resection and its vessel- and nerve-preserving variants, deepithelialisation, composite reduction, the butterfly technique, Z-plasty, W-shaped resection and radiofrequency-assisted methods) and using either scalpel or laser instruments were considered.

7.1.3. Information Sources and Search Strategy

A systematic search was conducted in three electronic databases: MEDLINE (via PubMed), EMBASE and the Cochrane Library (CENTRAL). The closing date of the search was October 2023. The search strategy combined controlled vocabulary and free-text terms relating to labiaplasty, labia minora reduction and the relevant surgical techniques and outcomes, with no language restriction applied at the search stage.

7.1.4. Study Selection and Data Extraction

Records retrieved from the three databases were collated and deduplicated. Titles and abstracts were screened against the eligibility criteria, after which the full texts of potentially eligible articles were assessed. Data extraction was performed using a

predesigned data collection form and included study characteristics, patient demographics (including age), surgical technique, surgical tool, number of patients, satisfaction outcomes and the number of events for each complication category. Study selection and data extraction were conducted in duplicate to ensure accuracy, with disagreements resolved by consensus.

7.1.5. Risk of Bias and Quality of Evidence Assessment

The methodological quality and risk of bias of the included studies were assessed using the Methodological Index for Non-Randomized Studies (MINORS).⁵ The MINORS instrument is specifically designed for the appraisal of non-randomised surgical studies. A predefined cut-off of ≥ 9 was applied for non-comparative studies and ≥ 18 for comparative studies to denote adequate methodological quality.

7.1.6. Data Synthesis and Analysis

All statistical analyses were performed in R (version 4.0.3) using the meta package (version 6.1-0). Outcomes were expressed as proportions with 95% confidence intervals (CI), and a random-effects model was applied throughout to account for the anticipated between-study heterogeneity.¹⁷ Between-study variance (τ^2) was estimated using the Paule-Mandel method, and confidence intervals for τ^2 were obtained by the Q-Profile method.^{18,19} The Hartung-Knapp adjustment was used for the confidence intervals of pooled estimates. Statistical heterogeneity was quantified using the I^2 statistic of Higgins and Thompson, with I^2 values exceeding 75% interpreted as indicating considerable heterogeneity.²⁰ Prediction intervals were calculated based on the t-distribution. Subgroup analyses by technique and by tool were performed, and differences between subgroups were tested. A p-value below 0.05 was considered statistically significant.

7.2. Study II.

7.2.1. Methodology and Protocol

Study II was conducted as a systematic review and meta-analysis following the Cochrane Handbook for Systematic Reviews of Interventions (Version 6.3) and reported in accordance with the PRISMA 2020 statement.³⁴ The review protocol was prospectively registered in PROSPERO (registration number: CRD42023481131).

7.2.2. Eligibility Criteria

Studies were eligible if they reported breastfeeding outcomes in women who had undergone breast surgery, classified into three categories: breast augmentation, breast reduction and nipple repair. For each category, studies reporting breastfeeding success according to surgical approach — incision type for augmentation and pedicle type for reduction — were of particular interest. Where available, control groups consisting of women without breast surgery were included for comparison.

7.2.3. Information Sources and Search Strategy

A systematic literature search was performed in MEDLINE (via PubMed), EMBASE and the Cochrane Library (CENTRAL). The search combined terms relating to breast augmentation, breast reduction, nipple surgery, lactation and breastfeeding. The closing date of the search was [to be confirmed by the author].

7.2.4. Study Selection and Data Extraction

Following deduplication, records were screened by title and abstract and then by full text against the eligibility criteria. Data extraction captured study characteristics, patient numbers, surgical category and technique (incision or pedicle type), and breastfeeding outcomes including success rates and, where reported, breastfeeding duration and the proportion of women who stopped or did not attempt breastfeeding. Study selection and data extraction were conducted in duplicate, with disagreements resolved by consensus.

7.2.5. Risk of Bias and Quality of Evidence Assessment

The risk of bias of the included non-randomised studies was assessed using the Methodological Index for Non-Randomized Studies (MINORS).⁵

7.2.6. Data Synthesis and Analysis

Statistical analyses were performed in R using a random-effects model to pool breastfeeding success proportions with 95% confidence intervals, accounting for between-study heterogeneity. Prediction intervals were calculated to express the expected range of true effects across settings. Subgroup analyses were performed by surgical category and by technique (incision type for augmentation, pedicle type for reduction), and differences between subgroups were tested. A p-value below 0.05 was considered statistically significant.

8. RESULTS

8.1. Study I: Comprehensive Assessment of Labiaplasty Techniques — Meta-Analysis

8.1.1. Study Search and Selection

The primary database search yielded 2,968 records. After deduplication and initial screening, 1,950 articles remained, of which 1,835 were excluded on the basis of their title and abstract. The full texts of 115 articles were reviewed, and 87 articles fulfilled the inclusion criteria. Of these, 53 studies provided data of adequate quality for quantitative synthesis and were included in the meta-analysis (Figure 1).

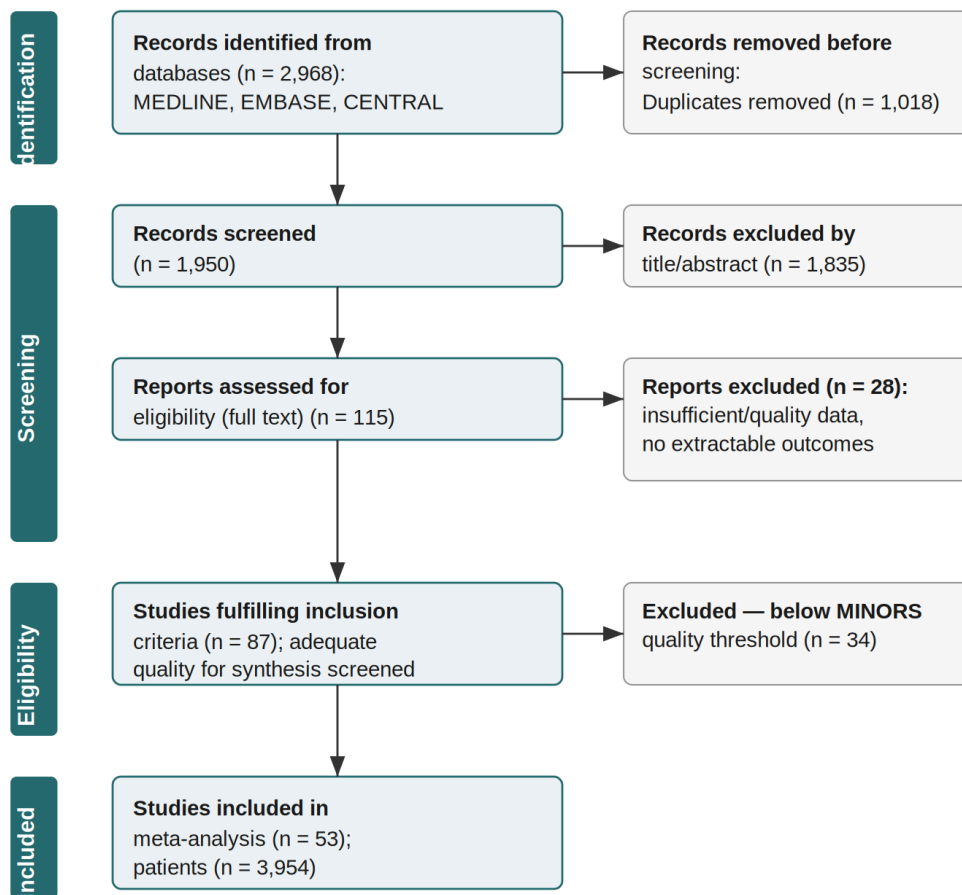


Figure 1. PRISMA 2020 flowchart representing the study selection process for Study I. Of 2,968 records identified across MEDLINE, EMBASE and CENTRAL, 53 studies (3,954 patients) met the quality threshold for quantitative synthesis.

8.1.2. Patient Characteristics

The 53 included studies comprised a total of 3,954 patients, all of whom were women, with ages ranging from 10 to 72 years. The most commonly reported indications for surgery were aesthetic dissatisfaction, discomfort in clothing, discomfort during sports and sexual activity, hygiene problems, recurrent infections and sexual dysfunction.

8.1.3. Patient Satisfaction

The overall pooled patient satisfaction, based on 53 studies (3,766 observations and 3,954 events), was **94.43%** (95% CI: 93.16%–95.48%; $I^2=20\%$). Satisfaction was consistently high across all surgical techniques, and there was no statistically significant difference between the technique subgroups ($\chi^2=10.33$, $df=9$, $p=0.325$). The technique-specific satisfaction rates are summarised in Table 1 and displayed in Figure 2.

Table 1. Pooled patient satisfaction by labiaplasty technique (Study I).

Technique	n (studies)	Satisfaction	95% CI	I^2
Overall	53	94.43%	93.16–95.48%	20%
Combination of techniques	2	93.94%	0–100%	88.5%
Wedge resection	15	95.73%	92.86–97.48%	23%
Wedge (vessel/nerve-preserving)	2	94.14%	2.67–99.99%	0%
Butterfly technique	6	94.41%	74.28–99%	0%
De-epithelialization	5	97.1%	85.49–99.48%	0%
Edge resection	13	95.89%	93.01–97.61%	46.6%
Composite reduction	10	92.93%	91.63–94.03%	0%
Radiofrequency	1	95.45%	55.17–99.72%	—
W-shape resection	1	96.43%	61.61–99.78%	—
Z-plasty	1	96.88%	64.97–99.81%	—

CI, confidence interval; I^2 , Higgins & Thompson heterogeneity statistic. “—” indicates a single-study subgroup for which I^2 is not estimable.

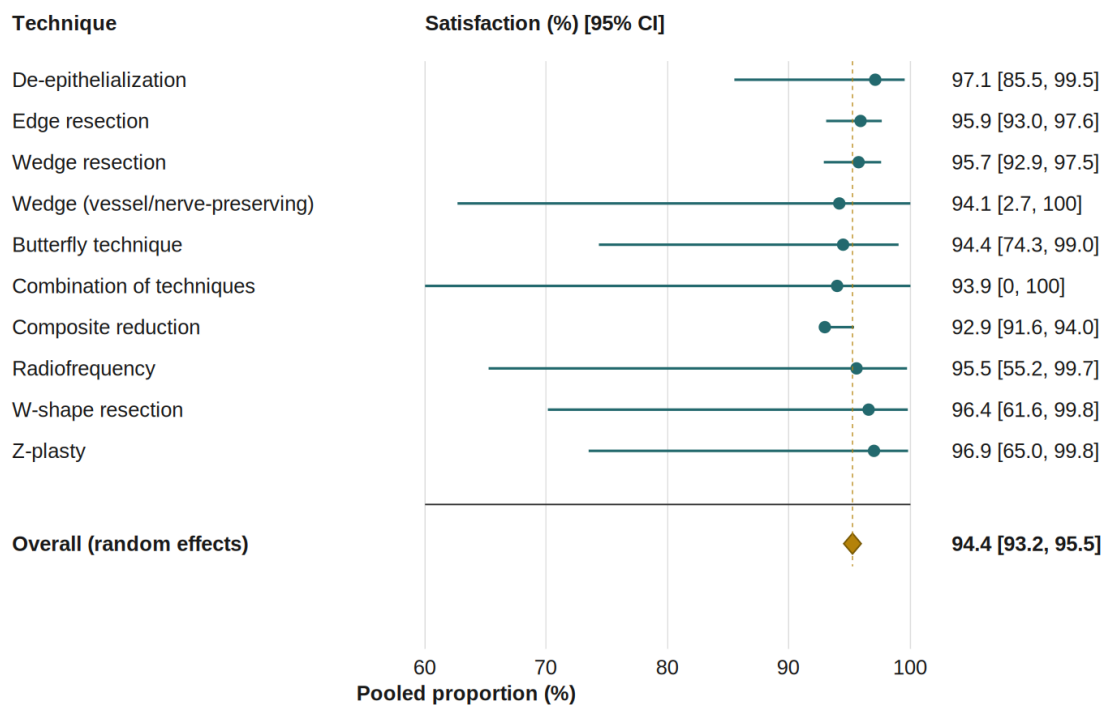


Figure 2. Forest plot representing pooled patient satisfaction (%) with 95% confidence intervals by labiaplasty technique. Point estimates are shown as circles and the overall random-effects estimate as a diamond; the dashed line marks the pooled value of 94.43%. No significant difference was detected between technique subgroups ($p=0.325$).

When satisfaction was analysed by surgical tool, the scalpel achieved a pooled satisfaction of 94.37% (95% CI: 78.93%–99.72%; $I^2=73.6\%$; $n=48$ studies) and the laser 97.34% (95% CI: 93.23%–99.34%; $I^2=0\%$; $n=5$ studies). The difference between tools was not statistically significant ($p=0.3448$). The low heterogeneity of the overall estimate ($I^2=20\%$) indicates that the pooled value of 94.43% is a stable and reliable summary of the literature.

8.1.4. Complications

Complication rates were generally low across all techniques and tools. The principal findings for each complication category are summarised in Table 2. By tool, the laser was associated with a significantly lower haematoma rate (1.35% vs 4.94%; $p<0.0001$), less swelling ($p<0.0001$) and less bleeding (0.93% vs 2.97%; $p=0.004$) than the scalpel. By technique, wound dehiscence differed significantly ($\chi^2=32.9$, $df=9$, $p=0.0001$): composite reduction had the lowest rate (2.71%) and Z-plasty the highest (13.33%),

while the vessel- and nerve-preserving wedge variant reduced dehiscence to 4.2% from 8.4% for the standard wedge — approximately a 50% reduction.

Table 2. Overall pooled complication rates and laser-versus-scalpel comparison (Study I).

Complication	Overall	Laser	Scalpel	Tool comparison
Haematoma	3.31%	1.35%	4.94%	p<0.0001
Dehiscence	5.91%	—	—	p=0.216 (ns)
Swelling	3.95%	lower	higher	p<0.0001
Bleeding	2.15%	0.93%	2.97%	p=0.004
Infection	3.01%	—	—	p=0.6155 (ns)
Total complications	8.88%	7.27%	8.94%	p=0.6931 (ns)

ns, not significant. Tool comparison p-values derive from subgroup tests of laser versus scalpel. Dashes indicate categories for which a tool-specific estimate was not separately reported.

Taken together, the complication analyses reveal a coherent dissociation: the surgical tool influenced chiefly bleeding-related events (haematoma, swelling and bleeding), where the laser was consistently superior, whereas the surgical technique influenced the outcomes tied to wound architecture and tissue handling (dehiscence and swelling). This allows the surgeon to address a patient's specific risk profile through an informed combination of instrument and method without compromising the uniformly high satisfaction the procedure affords.

8.1.5. Risk of Bias Assessment

The methodological quality of the included studies was assessed using the MINORS instrument, with cut-offs of ≥ 9 for non-comparative studies and ≥ 18 for comparative studies.⁵ Of the 87 articles fulfilling the inclusion criteria, 53 met the quality threshold and provided data adequate for quantitative synthesis. The predominance of non-comparative case series in the available literature represents the principal source of risk of bias, as reflected in the variable heterogeneity observed for several outcomes.

8.2. Study II: Effects of Breast Surgery on Breastfeeding — Systematic Review and Meta-Analysis

8.2.1. Study Search and Selection

A total of 57 studies fulfilled the inclusion criteria and were included in the systematic review and meta-analysis (Figure 3). Together these studies comprised 381,199 patients across the three predefined categories of breast surgery: breast augmentation, breast reduction and nipple repair.

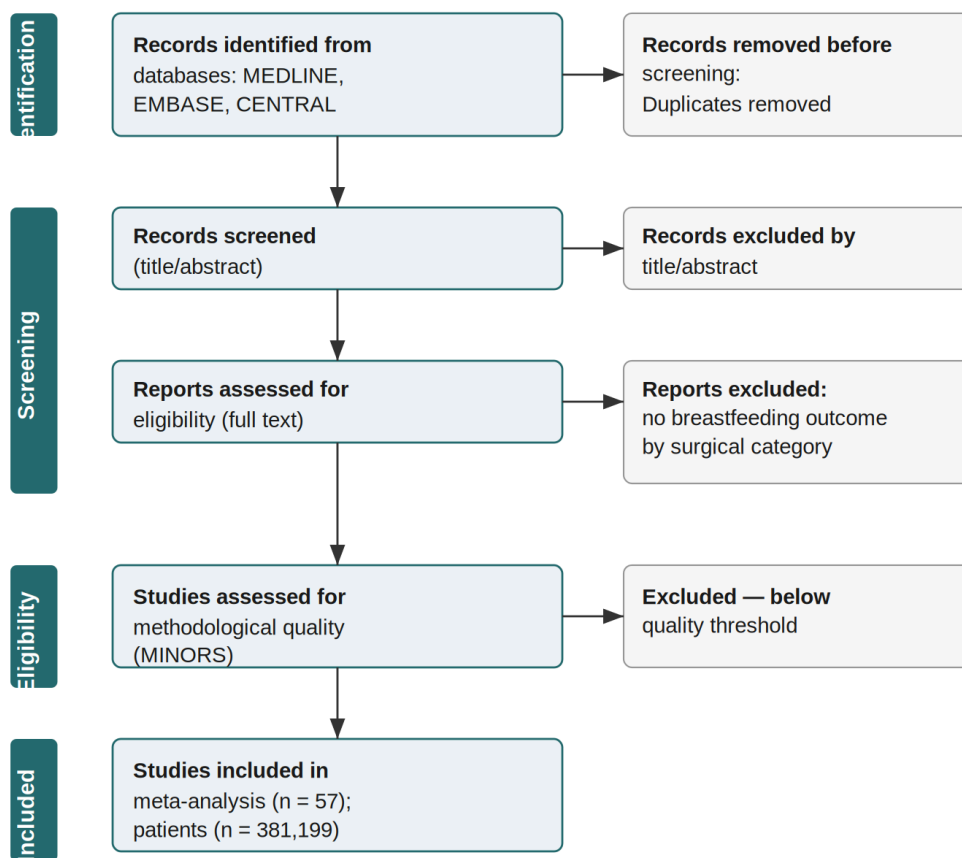


Figure 3. PRISMA 2020 flowchart representing the study selection process for Study II. Records identified across MEDLINE, EMBASE and CENTRAL were screened and appraised with MINORS, yielding 57 studies (381,199 patients) for quantitative synthesis.

8.2.2. Breast Augmentation Outcomes

The pooled breastfeeding success rate following breast augmentation was 73.4%, compared with 86% in control populations without augmentation. This difference did not reach statistical significance ($p=0.405$), and no single augmentation technique was associated with a statistically significant difference in breastfeeding success. When analysed by incision type, the inframammary incision was associated with the highest breastfeeding success (85.9%) and the periareolar incision with the lowest (63.1%) (Table 3). The wide prediction intervals observed in both the augmentation and control groups suggest that additional factors such as implant placement, sensory changes of the nipple-areola complex and the time elapsed since surgery also influence breastfeeding outcomes.

Table 3. Breastfeeding success by breast augmentation incision (Study II).

Group / incision	Breastfeeding success
Augmentation (overall)	73.4%
Control (no augmentation)	86%
Inframammary incision	85.9% (highest)
Periareolar incision	63.1% (lowest)

Values are pooled breastfeeding success proportions. Control denotes women without breast augmentation.

8.2.3. Breast Reduction Outcomes

Among breast reduction procedures, the choice of pedicle had a statistically significant effect on breastfeeding success ($p=0.021$). Techniques that preserve a robust neurovascular and ductal connection to the nipple-areola complex achieved markedly higher success rates than those that do not (Table 4, Figure 4). In the discussion of the source study, the inferior pedicle (81.1%) and the superior pedicle (63.0%) yielded the best results among the more commonly applied reduction techniques, a finding attributed to their superior preservation of the neurovascular and ductal supply of the nipple-areola complex.

Table 4. Breastfeeding success by breast reduction pedicle technique (Study II).

Pedicle technique	Breastfeeding success	95% CI
Horizontal pedicle	14.4%	0–96%
Vertical pedicle	26.2%	2–88%

Pedicle technique	Breastfeeding success	95% CI
Central pedicle	100%	0–100%
Superior-lateral pedicle	88%	70–98%
Superomedial pedicle	100%	81–100%
Central-superior-lateral pedicle	100%	86–100%

CI, confidence interval. Wide intervals for the horizontal and vertical pedicles reflect small subgroup sizes and between-study heterogeneity.

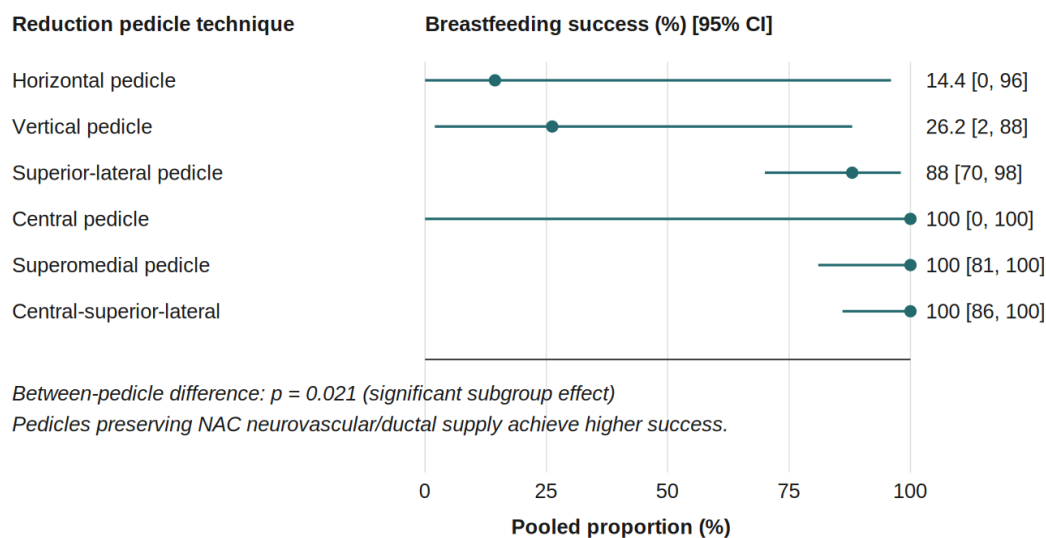


Figure 4. Forest plot representing pooled breastfeeding success (%) with 95% confidence intervals by breast reduction pedicle technique. Pedicles preserving the neurovascular and ductal supply of the nipple-areola complex achieved higher success; the between-pedicle difference was significant ($p=0.021$).

8.2.4. Nipple Repair Outcomes

Following nipple correction (repair) procedures, the overall pooled breastfeeding success rate was 84% (95% CI: 76%–89%). Nipple repair therefore did not substantially reduce breastfeeding success. Across the three categories, a consistent theme emerges: breastfeeding outcomes are most favourable when the surgical approach preserves the anatomical structures that subserve lactation.

8.2.5. Risk of Bias Assessment

The risk of bias of the 57 included studies was assessed using the MINORS instrument.⁵ As with Study I, the evidence base consisted predominantly of non-randomised studies, and the wide prediction intervals observed in several analyses reflect both the

methodological heterogeneity of the source studies and the multifactorial nature of breastfeeding outcomes.

9. DISCUSSION

9.1. Summary of Findings and International Comparisons

This thesis presents two of the largest quantitative syntheses to date addressing satisfaction and safety in labiaplasty and the lactational consequences of breast surgery. Considered together, they illustrate a single methodological philosophy — the disciplined pooling of fragmented, predominantly observational evidence — applied to two clinically distinct but conceptually related problems in female aesthetic and reconstructive surgery. The paragraphs that follow situate each principal finding within the wider international literature and draw out the clinical reasoning that connects the statistical results to bedside decisions.

In Study I, the overall pooled patient satisfaction of 94.43% confirms that labiaplasty is a highly satisfying procedure across the full range of described techniques, with no significant difference between the ten technique subgroups or between scalpel and laser. This consistency is reassuring and aligns with the conclusions of earlier narrative and systematic reviews, which repeatedly reported high satisfaction but were unable to place precise, pooled confidence intervals around technique-specific estimates.^{8,28} The present analysis extends that literature by demonstrating that the uniformity of satisfaction is not an artefact of heterogeneous reporting but persists even when outcomes are formally pooled under a random-effects model with conservative Hartung-Knapp intervals. From a counselling perspective, this means that a surgeon can reassure a prospective patient that, whatever technically appropriate approach is selected, the probability of a satisfying aesthetic and functional result is high and broadly comparable across methods.

The complication analyses, however, add clinically important nuance that a satisfaction-only reading would miss. Although total complication rates did not differ significantly between techniques or tools, the laser was associated with significantly lower rates of haematoma, swelling and bleeding than the scalpel. This pattern is biologically coherent: the coagulative and haemostatic action of laser energy on small vessels at the surgical margin would be expected to reduce precisely those bleeding-related events, and the observed more-than-threelfold reduction in haematoma is consistent with that mechanism.^{2,14} Conversely, the choice of technique — rather than

tool — significantly influenced wound dehiscence, the complication most closely tied to wound architecture and tension. Composite reduction achieved the lowest dehiscence rate, Z-plasty the highest, and, most importantly for surgical practice, the vessel- and nerve-preserving wedge variant roughly halved the dehiscence rate of the standard wedge. Because dehiscence prolongs healing, may necessitate revision and can compromise both the aesthetic and functional result, this reduction is clinically meaningful even though it did not translate into a difference in the composite total-complication endpoint.

The practical implication of this dissociation is that instrument and technique can be selected independently to match a patient's dominant risk concern. A patient in whom minimising bruising and bleeding is paramount may be best served by laser instrumentation; a patient in whom wound security is the priority may benefit from a vessel-preserving wedge or a composite approach. Crucially, because satisfaction is uniformly high, these safety-oriented choices need not be traded off against the quality of the aesthetic outcome. This reframes the labiaplasty technique debate away from a search for a single ‘best’ operation and towards individualised, risk-stratified selection.

In Study II, breastfeeding success after augmentation (73.4%) was lower than in non-augmented controls (86%), though the difference did not reach significance, and varied substantially by incision: the inframammary approach performed best (85.9%) and the periareolar approach worst (63.1%). The superiority of the inframammary incision is anatomically expected, since it avoids the periareolar tissue with its dense innervation and convergence of lactiferous ducts, and it is consistent with the direction of effect reported by earlier investigators such as Hurst and colleagues and Cruz and colleagues.^{28,29,30} The fact that the overall augmentation-versus-control difference did not reach statistical significance, despite a clinically noticeable 12.6-percentage-point gap, most likely reflects the heterogeneity of the source studies and the influence of factors not captured by incision type alone — implant placement plane, the degree of NAC sensory change, and the interval between surgery and lactation. The wide prediction intervals we observed make this explicit and caution against applying any single pooled figure mechanically to an individual woman.

Among reduction techniques, breastfeeding outcomes differed significantly ($p=0.021$), and the gradient followed the anatomy of the pedicle. Pedicles that preserve a robust neurovascular and ductal connection to the nipple-areola complex — including, among commonly used approaches, the inferior and superior pedicles — achieved the highest success, whereas approaches that sacrifice more of that connection performed worse. These observations accord with reports describing near-complete preservation of lactation with inferior pedicle techniques and provide a physiological rationale that is directly actionable: when future lactation is a stated priority, pedicle selection is not merely a technical preference but a decision with measurable functional consequences.^{31,32,33,34} Nipple correction procedures, by contrast, did not substantially compromise breastfeeding (84%), consistent with their comparatively limited disruption of the ductal system.

Placing the two studies side by side reveals a unifying principle that transcends the specific anatomy of either region: functional outcomes are best preserved when the surgical approach spares the structures that subserve the function in question. In labiaplasty, preserving the vascular and nervous supply of the labial tissue reduces dehiscence; in breast surgery, preserving the innervation and ductal continuity of the nipple-areola complex preserves lactation. This convergence is not coincidental but reflects a general surgical truth that meta-analysis is well placed to surface, precisely because it aggregates many small studies whose individual samples are too small to demonstrate it.

It is also instructive to compare the present syntheses with the existing guideline landscape. For breast reduction, current standards such as the ASPS evidence-based clinical practice guidelines prioritise symptom relief and safety but provide little or no guidance on lactational outcomes.³⁵ For breast implants, FDA guidance notes breastfeeding as a consideration and acknowledges the periareolar approach but offers no specific surgical recommendation, instead emphasising informed consent.^{6,36} The quantitative, technique-resolved estimates presented here begin to fill that gap, offering the kind of numerical detail that guideline developers and consent processes require. For labiaplasty, no comparable guideline currently standardises indications, technique nomenclature or outcome reporting, which both explains the fragmentation of the

primary literature and underscores the value of the pooled estimates provided in this thesis.

A closer examination of the labiaplasty complication findings repays attention, because the two significant technique-dependent effects — on dehiscence and on swelling — point to a common underlying mechanism. Both complications are sensitive to the amount of tension placed on the wound and to the preservation of perfusion at the wound edge. The vessel- and nerve-preserving wedge variant, which by design maintains the subdermal vascular plexus feeding the labial edge, would be expected to improve edge viability and thus reduce the risk that a closure breaks down; the observed halving of the dehiscence rate relative to the standard wedge is consistent with exactly that mechanism. Composite reduction, which distributes tissue removal across more than one plane rather than concentrating it at a single suture line, plausibly lowers peak wound tension, in keeping with its position as the technique with the lowest pooled dehiscence rate. The single-study techniques that appeared to carry higher dehiscence risk, such as Z-plasty, must be interpreted with great caution given their very wide confidence intervals, but the biological narrative they suggest — that more geometrically complex closures may be more vulnerable — is a hypothesis that future comparative work could test directly.

The tool-dependent findings are equally coherent when viewed mechanistically. The laser's advantage was confined to the three bleeding-related complications, haematoma, swelling and bleeding, and was absent for dehiscence, infection and the composite total-complication endpoint. This selective pattern is precisely what one would predict from an instrument whose distinguishing property is intraoperative coagulation of small vessels rather than any change to how the wound is designed or closed. The clinical corollary is important: adopting the laser can be expected to reduce bruising-related morbidity without, on the present evidence, either improving or worsening the structural integrity of the repair. Framed this way, the tool and the technique operate on largely independent axes of risk, and the surgeon can reason about them separately when planning an operation for a particular patient.

In the breast-surgery arm, the augmentation results deserve a similarly careful reading. The 12.6-percentage-point gap between augmented patients (73.4%) and controls (86%)

did not reach statistical significance, yet it would be a mistake to dismiss it as clinically unimportant on that basis alone. Non-significance in a proportion meta-analysis of heterogeneous observational studies reflects the width of the pooled uncertainty as much as the size of the underlying effect, and the wide prediction intervals we reported make clear that the true effect in any given setting could be considerably larger or smaller than the point estimate. What the incision-level analysis adds is a more actionable signal than the overall comparison: because the inframammary and periareolar approaches differ by more than twenty percentage points in pooled breastfeeding success, the choice of incision is a modifiable factor that a surgeon and patient can decide upon together, whereas the mere fact of having an implant is not. This is where a technique-resolved synthesis earns its value over a simple augmentation-versus-control contrast.

The reduction findings reinforce the same anatomical logic from a different direction. The statistically significant effect of pedicle choice ($p=0.021$), together with the gradient from lower success with pedicles that sacrifice more of the nipple's supply to near-complete preservation with pedicles that spare it, provides direct empirical support for the physiological principle that lactation depends on intact ductal continuity and neurovascular innervation of the nipple-areola complex. That the inferior and superior pedicles performed best among commonly used approaches is reassuring, because these are among the most widely taught and practised techniques; the message for practice is therefore not that surgeons must adopt unfamiliar operations, but that when future lactation matters to a patient, pedicle selection should be made deliberately with that goal in mind. Nipple repair, by contrast, disturbs the ductal system comparatively little, and its preserved success rate of 84% is consistent with that lesser degree of anatomical disruption.

Taken as a whole, the two studies also carry a methodological lesson that is itself a contribution of the thesis. In both fields, the primary literature is dominated by small, single-centre case series whose individual samples are far too small to detect the technique-level differences that matter clinically. Only by pooling, and by resolving outcomes at the level of specific incisions, pedicles, techniques and tools, do these differences become visible with usable precision. This is the essence of the translational-medicine rationale that frames the work: the aggregation of existing,

fragmented evidence into estimates that are immediately applicable at the bedside, while simultaneously exposing, through the very width of the intervals in the sparsest subgroups, exactly where new prospective data are most needed.

9.2. Strengths

The principal strengths of both studies derive from their methodological rigour. Both were prospectively registered in PROSPERO, conducted in accordance with the Cochrane Handbook (Version 6.3) and reported following PRISMA 2020, thereby minimising reporting and selection bias.³⁴ The searches spanned three major databases (MEDLINE, EMBASE and CENTRAL) without language restriction at the search stage, and study selection and data extraction were performed in duplicate with disagreements resolved by consensus, reducing the risk of reviewer error. Risk of bias was assessed with the validated MINORS instrument, which is specifically designed for the appraisal of non-randomised surgical studies.⁵

The scale of the pooled samples is a further strength: 3,954 patients across 53 studies in Study I and 381,199 patients across 57 studies in Study II confer substantial statistical power and allow subgroup analyses at the level of individual techniques, incisions and pedicles that no single primary study could support. The consistent use of random-effects models with Hartung-Knapp adjustment and the reporting of prediction intervals alongside confidence intervals provide a transparent and honest account of the heterogeneity inherent in this literature, distinguishing the precision of the average estimate from the range of effects that might be expected in a new clinical setting.

9.3. Limitations

Several limitations must be acknowledged. The evidence base for both questions consists predominantly of non-randomised, single-centre case series, with very few comparative studies and no randomised controlled trials. This design limitation constrains causal inference and means that residual confounding — by surgeon experience, patient selection, or unmeasured anatomical factors — cannot be excluded. Considerable heterogeneity was observed for some outcomes (for example, scalpel satisfaction and total complications in Study I), and the wide prediction intervals in Study II indicate that pooled estimates may not transfer directly to every clinical setting.

Outcome definitions varied between studies, particularly the definition of ‘satisfaction’ and of ‘breastfeeding success’, which were operationalised inconsistently — from single binary questions to validated instruments in the former case, and from any breastfeeding to exclusive or sustained breastfeeding in the latter. Several technique subgroups were represented by only one or two studies, yielding imprecise estimates with very wide confidence intervals (for example, the single-study estimates for Z-plasty, W-shape resection and radiofrequency in Study I, and the horizontal and vertical pedicle subgroups in Study II). These estimates should be regarded as hypothesis-generating rather than definitive. Finally, publication bias cannot be fully excluded, and the reliance on aggregate rather than individual-patient data prevented adjustment for patient-level covariates. These limitations reflect the state of the primary literature rather than the conduct of the meta-analyses, and they directly motivate the recommendations for future research set out below.

10. CONCLUSIONS

This thesis demonstrates, through two large and methodologically rigorous meta-analyses, that:

- Labiaplasty achieves uniformly high patient satisfaction (overall 94.43%), with no significant difference between the ten surgical techniques or between scalpel and laser.
- Complication rates after labiaplasty are low; the laser significantly reduces haematoma, swelling and bleeding compared with the scalpel, while vessel- and nerve-preserving wedge resection approximately halves the rate of dehiscence relative to standard wedge resection, and composite reduction has the lowest dehiscence rate overall.
- Breast augmentation is associated with somewhat lower breastfeeding success (73.4%) than in non-augmented controls (86%), with the inframammary incision (85.9%) clearly outperforming the periareolar incision (63.1%).
- Breast reduction outcomes for breastfeeding depend significantly on pedicle choice ($p=0.021$), with techniques that preserve the neurovascular and ductal supply of the nipple-areola complex — notably the inferior and superior pedicles among common approaches — yielding the best results.
- Nipple repair does not substantially compromise breastfeeding (84%).

Collectively, these conclusions provide an evidence base that can directly support surgical decision-making and patient counselling in two common domains of female aesthetic surgery.

11. IMPLICATIONS FOR PRACTICE

For labiaplasty, surgeons may reassure patients that high satisfaction is achievable regardless of the specific technique selected. Because the choice of tool and technique influences specific complications, practice can be individualised: laser instrumentation may be preferred where minimising haematoma, swelling and bleeding is a priority, while vessel- and nerve-preserving wedge resection or composite reduction may be favoured to reduce the risk of wound dehiscence.

For breast surgery, the findings support reproduction-aware counselling. Women who wish to preserve breastfeeding capacity and are candidates for augmentation may benefit from an inframammary rather than a periareolar incision. In breast reduction, pedicle techniques that preserve the neurovascular and ductal supply of the nipple-areola complex should be considered when future lactation is a priority. In all cases, these quantitative estimates strengthen the informed-consent process emphasised by professional bodies such as ACOG and the FDA.⁶

12. IMPLICATIONS FOR RESEARCH

12.1. Methodology and Study Design

The predominance of non-randomised case series in both fields is the most important methodological limitation identified by this thesis. Future research should prioritise prospective, comparative and, where feasible, randomised study designs, with adequate sample sizes and standardised, validated, patient-reported outcome measures. Harmonised definitions of ‘satisfaction’ and ‘breastfeeding success’, together with consistent reporting of surgical technique and tool, would greatly enhance the comparability and poolability of future evidence.

12.2. New Areas

Several specific areas warrant dedicated investigation. For labiaplasty, the apparent advantage of vessel- and nerve-preserving modifications in reducing dehiscence, and of the laser in reducing haematoma, swelling and bleeding, should be confirmed in head-to-head comparative studies. For breast surgery, the roles of implant placement, nipple-areola complex sensory changes and time since surgery in determining breastfeeding outcomes deserve focused study, as does the long-term durability of lactation across pedicle techniques. Research linking surgical technique to objective measures of milk production and infant outcomes would be particularly valuable.

13. IMPLICATIONS FOR POLICY MAKERS

The evidence assembled here has implications for clinical guidelines and regulatory guidance. Current standards for breast reduction, such as the ASPS evidence-based guidelines, prioritise symptom relief but offer no guidance on lactational outcomes, and FDA guidance for breast implants, while noting breastfeeding as a consideration, provides no specific surgical recommendations.^{6,35} Given the well-established public-health importance of breastfeeding promoted by the WHO, policy makers and professional societies should consider incorporating lactation-preservation considerations into surgical guidelines and informed-consent standards. For labiaplasty, the wide age range of patients — including young women — and the variability in indications and outcomes support the development of standardised classification and reporting frameworks to safeguard patients.

14. FUTURE PERSPECTIVES

The two studies in this thesis convert a fragmented body of evidence into robust pooled estimates while simultaneously exposing the gaps that future work must address. The clearest path forward lies in the standardisation of nomenclature, outcome definitions and reporting across both fields, followed by the conduct of prospective, multicentre studies using validated patient-reported outcome measures. For labiaplasty, technique optimisation — particularly the further development and comparative evaluation of vessel- and nerve-preserving approaches — offers a promising route to reducing complications while maintaining the already high satisfaction rates. For breast surgery, future research should aim to define, for each procedure and technique, the expected impact on lactation with sufficient precision to support genuinely individualised, reproduction-aware decision-making. Pursuing these directions within the translational medicine framework, which deliberately accelerates the cycle from observation to validated practice, will allow the aggregated findings presented here to be translated into measurable improvements in patient care.^{21,22}

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16.2. Publications not Related to the Thesis

None.

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