Microsurgery

WILEY

MICROSURGERY

REVIEW ARTICLE OPEN ACCESS

Postoperative Morbidity Outcomes Associated With Superficial Temporal Versus Cervical Vessels as Recipient Vessels in Head and Neck Reconstruction: A Systematic Review and Meta-Analysis

Woo Shik Jeong[1] | Woonhyeok Jeong[2]

[1]Department of Plastic Surgery, Asan Medical Center, Ulsan University College of Medicine, Seoul, Korea | [2]Department of Plastic and Reconstructive Surgery, Dongsan Medical Center, Keimyung University College of Medicine, Daegu, Korea

Correspondence: Woonhyeok Jeong (psjeong0918@gmail.com)

Received: 13 June 2024 | **Revised:** 5 August 2024 | **Accepted:** 17 October 2024

Funding: This study was supported by Korea Medical Device Development Fund grant funded by the Korean government (the Ministry of Science and ICT; the Ministry of Trade, Industry and Energy; the Ministry of Health & Welfare; and the Ministry of Food and Drug Safety) (Project Number: RS-2022-00140622).

Keywords: anastomosis | free tissue flaps | head and neck neoplasms | microsurgery | postoperative complications | surgical

ABSTRACT

Background: The purpose of this meta-analysis was to compare the surgical outcomes of head and neck reconstruction via free flap surgery, with neck vessels versus superficial temporal vessels as recipient vessels.

Methods: The PubMed, Embase, and Scopus databases were systematically searched via the following keywords: ("superficial temporal" OR "temporal") AND ("free flap" OR "free tissue transfer") AND ("head and neck" OR "face"). The following data were extracted: first author, publication year, flap type, reconstruction region, concordant vein graft, recipient vessel, and postoperative complications, including thrombosis, partial necrosis, and flap failure. The recipient vessels were divided into two groups: the superficial temporal artery (STA)/V group and the neck group.

Results: Six hundred and thirty-five studies that met the inclusion criteria were included and reviewed systematically for a meta-analysis. Compared with the neck vessel group, the STA/V vessel group had a significantly greater risk of flap failure (odds ratio: 2.18; 95% CI: 1.32–3.60; $p=0.002$), with low heterogeneity ($p=0.84$; $I^2=0\%$). However, there were no significant differences in the rates of thrombosis or partial necrosis.

Conclusions: Compared with the use of neck vessels, the use of STA/V vessels as recipient vessels for head and neck reconstruction could increase the risk of total flap necrosis. Considering these findings, surgeons should exercise caution when selecting the STV as the recipient site, and as some authors have suggested, proximal dissection may be necessary during surgery.

1 | Introduction

For the reconstruction of oncologic defects in the head and neck, options include skin grafts, pedicled flaps, and prosthetics (Yang et al. 2021; Chung, Byun, and Lee 2019; Saleki et al. 2023). Free flaps, however, are considered the best option for providing sufficient volume and composite tissue, including bone (Tamaki and Zender 2023). The survival of a free flap depends critically on the selection of an appropriate recipient vessel (Yazar et al. 2005). The most commonly chosen vessels after neck dissection are the branches of the internal carotid artery (ICA) for arterial supply and the branches of the external jugular vein (EJV) and internal jugular vein (IJV) for venous drainage (Yazar et al. 2005). The most frequently utilized arteries are the superior thyroidal artery and the facial artery, whereas the veins include branches of the EJV and IJV, with direct end-to-side anastomosis to the IJV also being a common practice (Yazar et al. 2005). In cases requiring a long pedicle due to the distance to neck vessels, such as in the midface and scalp, or in the presence of a vessel-depleted neck due to prior radiotherapy, the superficial temporal vessel serves as a second option (Moreno et al. 2010; Triana Jr. et al. 2000; Philips et al. 2019; Andrades et al. 2008).

The superficial temporal artery (STA) and the superficial temporal vein (STV) are branches of the external carotid artery (ECA) and the EJV, respectively. Although the STV does not have a predictable course, the STA exhibits relatively less anatomical variation and is superficially located, thus offering good accessibility as a recipient vessel (Ausen and Pavlovic 2011). In midface and scalp reconstruction, the use of superficial temporal vessels as recipient vessels offers several benefits. These include their superficial course, which facilitates dissection, and their shorter distance compared with neck vessels (Ausen and Pavlovic 2011). There are also several disadvantages: the small diameter of these vessels can lead to challenges in matching during microanastomosis, frequent vasospasm, and difficulty in anastomosis due to the thin walls of the veins (Panje and Morris 1991; Yano et al. 2012). However, recent studies have indicated that there is no difference in flap survival rates between free flaps using superficial temporal vessels and those using neck vessels as recipient vessels. Most of these studies are case series or retrospective analyses, which are limited by their low level of evidence. Therefore, our meta-analysis aimed to compare the extent of postoperative complications between groups in which superficial temporal vessels and neck vessels were used as recipient vessels in patients who underwent head and neck reconstruction with free flaps.

2 | Materials and Methods

2.1 | Search Strategy and Eligibility Criteria

The PubMed, Embase, and Scopus databases were systematically searched through March 2024. The following keywords were used in the search: ("superficial temporal" OR "temporal") AND ("free flap" OR "free tissue transfer") AND ("head and neck" OR "face"). The preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines were followed to perform this systematic review and meta-analysis.

The inclusion criteria for this review consisted of the following: (1) studies reporting the use of a free flap for head and neck reconstruction and (2) a clear description of postoperative complications associated with the selected recipient vessel, including the STA, STV, and neck vessels. The exclusion criteria for this review were as follows: (1) review articles, case reports or case series reporting no comparison data for the selection of recipient vessels; (2) studies written in a language other than English; (3) animal or cadaver studies; and (4) studies with no clear description of outcomes associated with the selected recipient vessels.

2.2 | Study Selection and Data Collection

Data were collected by a single author (Jeong W). The following data were extracted: first author; publication year; study type; flap type; reconstruction region; concordant vein graft; recipient vessel; and postoperative complications, including thrombosis, partial necrosis, and flap failure. The recipient vessels were divided into two groups: the STA/V group and the neck group. The neck vessels include the facial artery and vein, superficial thyroid artery and vein, lingual artery and vein, transverse cervical artery and vein, ascending pharyngeal artery and vein, ECA, and external and internal jugular veins. The outcomes compared in our investigation were thrombosis, partial necrosis of the flap, and flap failure. A meta-analysis was performed to compare each type of postoperative complication when a minimum of three relevant articles were available. A meta-regression analysis was performed to analyze the influence of sample size and study design on the effect sizes reported across multiple studies. The analysis was conducted to understand the heterogeneity observed in the meta-analysis and to identify whether sample size and study design significantly contributed to the variability in effect sizes.

2.3 | Statistical Analysis

For the pooled data, odds ratios were analyzed, and 95% confidence intervals (CIs) were calculated from the original data. The Q statistic for heterogeneity and the I^2 index were calculated. For the I^2 index, the percentage of total variation due to heterogeneity was classified into three intervals: $0 < I^2 < 50$, $50 < I^2 < 75$, and $I^2 > 75$, representing low, moderate, and severe heterogeneity, respectively. A random effects model was used, and the variances of the random effects model were obtained via the method of DerSimonian and Laird (DerSimonian and Laird 1986). The pooled odds ratio and CI are presented as the outcome. Microsoft Excel (Microsoft Corporation, Redmond, USA) was used for data collection, and RevMan version 5.3 was used for statistical analysis. The risk of bias within studies was assessed via the Cochrane Collaboration tool (Higgins and Altman 2017). The meta-regression analysis was conducted via the R statistics package (http://www.r-project.org).

3 | Results

The literature search for this systematic review retrieved 635 studies from PubMed, EMBASE, and Scopus. After deleting duplicate studies, 468 studies were selected for screening. After screening, 112 studies were selected for a detailed full-text review. Finally, 12 studies were included in the systematic review (Figure 1). In total, 2083 flaps were included in this study. The selected studies were carefully reviewed and summarized to conduct the meta-analysis (Table 1).

3.1 | Thrombosis

For thrombosis, six studies with 116 STA/V and 450 neck vessels were assessed. The pooled odds ratio was 1.65 (95%

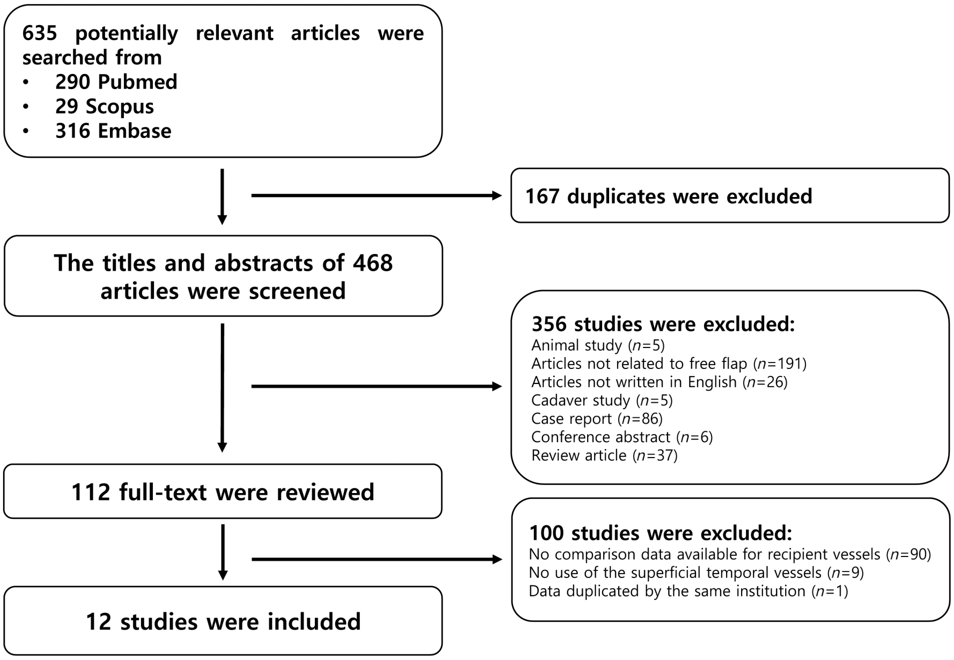

FIGURE 1 | Flow diagram used to identify and select studies.

CI: 0.70–3.86; $p = 0.25$), with low heterogeneity ($p = 0.61$; $I^2 = 0\%$). This result was obtained via a random effects model (Figure 2A). To assess publication bias, we performed a funnel plot analysis. The funnel plot revealed no significant publication bias in the meta-analysis. The studies seemed to be distributed around the vertical line, which typically represents the overall effect size estimate. The symmetry of the plot suggested that small and large studies reported similar effect sizes, which is a good indication of the robustness of the meta-analysis results (Figure 2B). However, there was no significant difference in the risk of thrombosis between the two groups.

3.2 | Partial Necrosis

For partial necrosis, three studies with 38 STVs and 293 neck vessels were assessed. The pooled odds ratio was 1.39 (95% CI: 0.38–5.13; $p = 0.62$), with low heterogeneity ($p = 0.62$; $I^2 = 0\%$). This result was obtained via a random effects model (Figure 3A). The funnel plot revealed no obvious asymmetry, indicating that there may not be significant publication bias in the meta-analysis (Figure 3B). There was no significant difference in the risk of partial flap necrosis between the two groups.

3.3 | Flap Failure

Data on flap failure, including total flap necrosis and total flap loss, were extracted from the included studies. In the analysis of flap failure, when the anastomotic site included both the neck and the superficial temporal region, the analysis was conducted on the basis of cases involving the STV. For flap failure, 11 studies with 389 STVs and 1872 neck vessels were assessed. The pooled odds ratio was 2.18 (95% CI: 1.32–3.60; $p = 0.002$), with low heterogeneity ($p = 0.84$; $I^2 = 0\%$). This result was obtained via a random effects model (Figure 4A). The funnel plot provided appeared symmetrical around the vertical axis, which suggests that there is no clear evidence of publication bias (Figure 4B). This result indicated that the risk of flap necrosis was significantly greater in the group in which the STV was used as the recipient vessel than in the group in which the neck vessel was used.

3.4 | Sensitivity Analyses

In the meta-regression analysis, neither the sample size nor the study design were statistically significant predictors of effect size variability. The coefficients for sample size and study design were 0.02 ($p = 0.45$) and −0.03 ($p = 0.65$), respectively. This suggests that neither the sample size nor the study design significantly contributed to explaining the heterogeneity among the study effect sizes.

4 | Discussion

In summary, our meta-analysis revealed that the use of the STA/V as the recipient vessel for free flap reconstruction did not increase the risk of thrombosis or partial necrosis. However, the use of the STV as a recipient vessel could significantly increase the risk of flap necrosis compared with the use of the neck vessel as a recipient vessel in free flap reconstruction of head and neck defects.

The superficial temporal artery has long been utilized as a vessel in cerebral artery bypass surgery (Abdelgadir et al. 2023). However, the STA/V has been recognized as unsuitable as a recipient vessel for free flaps due to various anatomical factors (Halvorson et al. 2009). First, the vessel diameter is small, often presenting a significant discrepancy with that of the donor vessel

TABLE 1 | Characteristics of articles.

Study no.	Author	Year	Design	Flap type	Reconstruction region	Vein graft cases (*n*; vessels)	Recipient vessel (*n*; cases)	Thrombosis (*n*)	Partial necrosis (*n*)	Flap Failure (*n*)
1	Halvorson et al. (2009)	2009	Retrospective	NA	NA	Neck A/V (NA/NA)	Neck A/V (282:282)	6	10	3
				RF (4), ALT (3), LD (8), GF (1), RA (11), PS (1)	Orbit (13), Scalp (15)	ST A/V (NA/NA)	ST A/V (28:28)	2	2	0
2	Iida et al. (2016)	2016	Retrospective	SCIP (8), SIEA (2), ALT (1), ICAP (1)	EAC (4), Face (3), Mandible (1), Parotid (2), Pharynx (1), Tongue (1)	Neck A/V (0/0)	Neck A/V (8:9)	1	1	0
						ST A/V (0/0)	ST A/V (4:3)	0	0	0
3	Las et al. (2016)	2016	Retrospective	RF (189), FF (192), ALT (108), LD (20), GF (9), RA (6), PS (5), SA (4)	Oral (347), Scalp/face (49), Pharynx (33), Midface (30)	Neck A/V (NA)	Neck A/V (434:443)	NA	NA	22
						ST A/V (NA)	ST A/V (56:52)	NA	NA	8
4	Li et al. (2018)	2018	Retrospective	FF (61), RF (9), PS (1), LD (6), ALT (18), AMT (2), TFL (1)	Maxilla (86), Zygoma (1), Maxilla and zygoma (13)	Neck A/V (5/5)	Neck A/V (56:56)	4	NA	1
						ST A/V (1/1)	ST A/V (44:44)	1	NA	0
5	Lin et al. (2014)	2014	Retrospective	ALT (9)	Scalp (9)	Neck A/V (NA/NA)	Neck A/V (2:2)	4	1	0
						ST A/V (NA/NA)	ST A/V (7:7)	1	2	0
6	Meleca et al. (2021)	2021	Retrospective	ALT (24)	Mandible (6), Maxilla (4), Skull base & spine (3), Skull (1)	Neck A/V (NA)	Neck A/V (13:13)	NA	NA	1
						ST A/V (NA)	ST A/V (11:11)	NA	NA	0
7	Nahabedian et al. (2004)	2004	Retrospective	RF (25), LD (23), RA (21), FF (12), PS (6), LA (5), Jej (3), ALT (2), GF (2), DIEP (1), SA (1), TFL (1)	Midface (25), Scalp (20), Mandible (13), Oral (13), Orbit (9), Forehead (7), Skull base (7), Esophagus (3), Neck (3), Lip (2)	Neck A/V (5/5)	Neck A/V (80:80)	6	NA	3
						ST A/V (1/1)	ST A/V (22:22)	3	NA	2

(Continues)

TABLE 1 | (Continued)

Study no.	Author	Year	Design	Flap type	Reconstruction region	Vein graft cases (*n*; vessels)	Recipient vessel (*n*; cases)	Thrombosis (*n*)	Partial necrosis (*n*)	Flap Failure (*n*)
8	Revenaugh et al. (2015)	2015	Retrospective	ALT (47), FF (24), LD (12), RF (3), SC (2), GF (1)	Maxilla (37), Scalp (16), Nose/Skull base (11), Oral (8), Mandible (8), Orbit (4), Ear (3), Other (2)	Neck A/V (0/0)	Neck A/V (56:56)	NA	NA	1
						ST A/V (0/0)	ST A/V (33:33)	NA	NA	1
9	Scaglioni et al. (2016)	2016	Retrospective	LMTP (15)	Togue (6), Gum (5), Buccal (3), Soft palate (1)	Neck A/V (NA)	Neck A/V (8:8)	1	NA	1
						ST A/V (NA)	ST A/V (7:7)	1	NA	0
10	Sousa et al. (2023)	2023	Prespective	ALT (13), RA (9), RF (3), LD (2)	Midface (23), Scalp (4)	Neck A/V (0/0)	Neck A/V (15:15)	1	NA	1
						ST A/V (0/0)	ST A/V (12:12)	2	NA	2
11	Tan et al. (2014)	2014	Retrospective	ALT (485), RF (194), FF (166), Jej (8)	Oral (693), Oropharynx (95), Hypopharynx (65)	Neck A/V (NA)	Neck A/V (793:793)	NA	NA	39
						ST A/V (NA)	ST A/V (60:60)	NA	NA	6
12	Vos et al. (2024)	2023	Retrospective	ALT (199), FF (17), RF (15), LD (3), SC (1), SA (1)	Mandible (53), Cranium (33), Maxilla (31), Skull base (30), Palate (29), Nose (25), Vestibule (12), Orbit (7), Skin (6), Other (10)	Neck A/V (NA)	Neck A/V (117:117)	NA	NA	3
						ST A/V (NA)	ST A/V (117:117)	NA	NA	5

Abbreviations: A, artery; ALT, anterolateral thigh free flap; AMT, anteromedial thigh free flap; DIEP, deep inferior epigastric perforator free flap; EAC, external auditory canal; FF, fibular free flap; GF, gracilis free flap; ICAP, intercostal artery perforator free flap; Jej, jejunal free flap; LA, lateral arm free flap; LD, latissimus dorsi free flap; PS, parascapular free flap; RA, rectus abdominis free flap; RF, radial forearm free flap; SA, serratus anterior free flap; SC, supraclavicular free flap; ST, superficial temporal; TFL, tensor fascia lata free flap; V, vein.

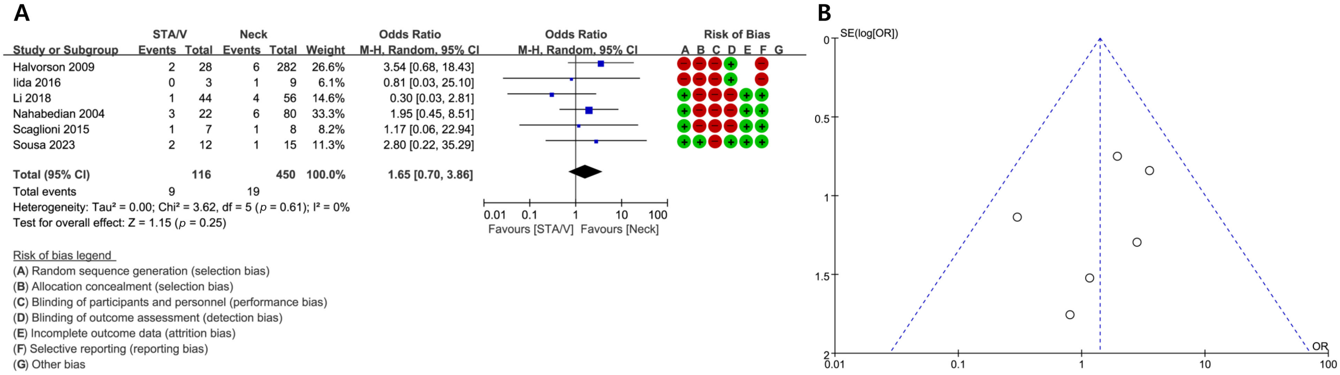

FIGURE 2 | Forest plot (A) and funnel plot (B) for thrombosis. The funnel plot revealed no significant publication bias. In the forest plot, there was no significant difference in the risk of thrombosis between the two groups.

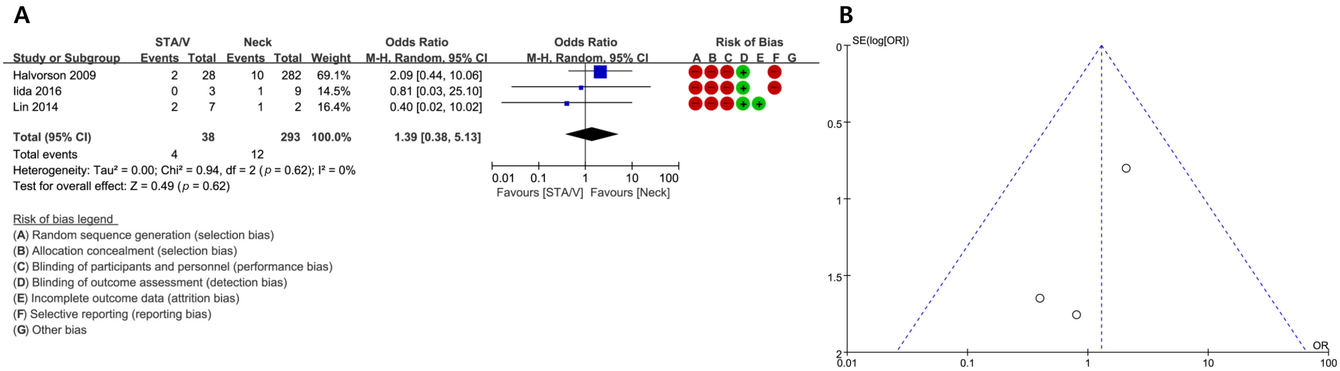

FIGURE 3 | Forest plot (A) and funnel plot (B) for partial necrosis. The funnel plot revealed no significant publication bias. In the forest plot, there was no significant difference in the risk of partial necrosis between the two groups.

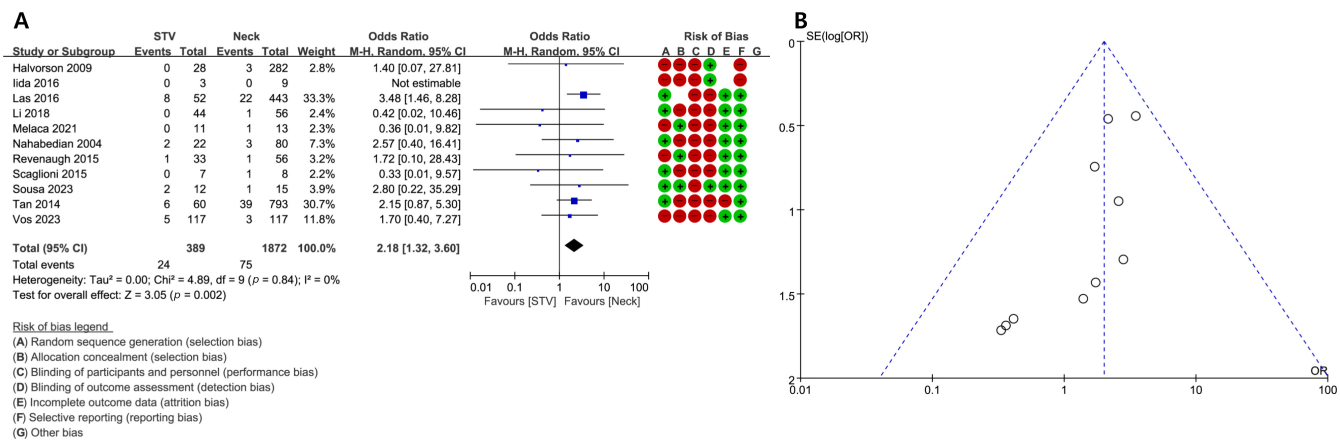

FIGURE 4 | A forest plot (A) and a funnel plot (B) for flap failure. The funnel plot revealed no significant publication bias. In the forest plot, flap necrosis was significantly greater in the group in which the STV was used as the recipient vessel than in the group in which the neck vessel was used.

of the free flap. Second, the vessel wall is thin, and the vessels are located in a relatively superficial layer, making them prone to vasospasm. Third, the position of the vessels can vary anatomically. Nonetheless, in some patients, such as those who have undergone radiation therapy and have a vessel-depleted neck or those requiring midface or scalp reconstruction, the STA/V, located anatomically close, can be a suitable recipient vessel. Consequently, many authors have used the STA/V as the recipient vessel for free flap reconstructions and have reported various outcomes (Las et al. 2016; Nahabedian et al. 2004; Sousa et al. 2023).

Nahabedian et al. (2004) reported the use of 22 STAs/V as recipient vessels for a total of 102 flaps, and there was no significant association between the incidence of flap failure and the selected recipient vessel. They reported five cases of flap failure in which the STA was used, one case of STV thrombosis, and three cases of neck vessel thrombosis. In their study, they reported that the selected recipient vessel was not related to flap failure; however, this research is a case series study that has a low level of evidence. Similarly, Halvorson et al. (2009) compared STA/V and neck vessels as recipient vessels for microvascular orbital and scalp reconstruction and reported no significant differences in the rates of thrombosis, partial flap loss, or flap failure between the two groups. However, Las et al. (2016) conducted a large-scale study involving 1530 free flaps and reported that 548 free flaps were used for head and neck reconstruction. In contrast to previous studies, they reported a 4.4-fold greater risk of total flap necrosis when the STA was used as the recipient vessel. However, this was a retrospective study that did not have the same high level of evidence as a randomized controlled study; therefore, the reliability of the results may be lower. In 2023, a prospective randomized controlled study involving 27 free flaps compared the use of the STA/V and neck vessels as recipient vessels for head and neck reconstruction (Sousa et al. 2023). They also reported that there was no significant difference in flap failure rates between the STA/V group and the neck vessel group (16.67% in the STA/V group vs. 6.66% in the neck vessel group; $p = 0.56$). Moreover, the incidence of minor complications, including seroma, partial dehiscence, and infection, did not differ between the two groups. However, this study also included a small number of free flaps and revealed inconclusive results regarding the risk of flap failure due to the selected recipient vessels.

To compensate for the discrepancies in conclusions across different studies, we conducted a meta-analysis and synthesized the results of published papers, thereby obtaining findings that were distinct from those of previous studies. Although the risks of thrombosis and partial necrosis were not different between the superficial temporal vessels and the neck vessels, the risk of flap failure was significantly greater in the STA/V group. The authors speculate that the hypothesis derived from these results is due to researchers with experience in using STA/V reporting study outcomes. Consequently, there is likely no significant difference in the risk of thrombosis or partial necrosis between the STA/V and neck vessels (Halvorson et al. 2009). The studies included in our meta-analysis recommended compensating for the discrepancy in the diameter of the STA/V by performing proximal dissection to ensure that the STA/V has a larger diameter (Halvorson et al. 2009; Li et al. 2018; Revenaugh et al. 2015). Intraparotid dissection of the STA/V ensures adequate vessel size and a reliable anatomical course of the STA/V (Hansen et al. 2007; Shimizu et al. 2009).

The significantly greater risk of flap failure in the STA/V group in our meta-analysis is likely also related to anatomical factors. It is well known that the STA/V exists in the superficial layer, making it susceptible to compression from external forces, and its vessel wall is thin, leading to a greater risk of vascular spasm (Sousa et al. 2023; Shimizu et al. 2009; Panje and Morris 1991). Postoperative adverse events caused by vasospasm often occur late and are difficult for the operator to predict. In the prospective randomized controlled study included in our study, two cases of flap necrosis occurred in the STA/V group: one due to vein thrombosis on postoperative Day 3 and another due to arterial thrombosis on postoperative Day 5 (Sousa et al. 2023). The occurrence of arterial thrombosis on postoperative Day 5 is particularly rare and is most likely due to vascular spasm. In addition, according to our experience, when the STA/V is used, if the defect and recipient vessel are close to each other, the length of the pedicle may not be sufficiently secured. This can result in a short pedicle, potentially causing vascular spasms due to traction. When creating a subcutaneous tunnel to deliver the pedicle toward the STA/V, it is imperative to make the tunnel sufficiently large to prevent compression from postoperative edema. Additionally, since the pedicle exists in the superficial layer, it is beneficial to advise the patient to avoid compression from sleeping, glasses, or mask straps, which can lead to delayed thrombosis.

Our study also has several limitations. First, most of the included studies were retrospective or case series studies that did not control for bias. As a result, most studies have the limitation of not being able to compare the STV with a specific neck vessel in isolation. This is due to the inherent difficulties in conducting prospective studies on surgical interventions, leading many studies to utilize retrospective grouping for analysis. However, these studies, when considered individually, have a low level of evidence. One method to increase the level of evidence and obtain integrated results from these studies is through a meta-analysis. Indeed, in our research, most of the included studies reported no significant difference in flap failure rates between the two groups, but the meta-analysis results indicated a difference. Another limitation is that, while there are no missing results for flap necrosis outcomes, there are many missing results for thrombosis and partial flap necrosis. This could have distorted the results and affected the reliability of the meta-analysis. Therefore, the findings regarding the lack of difference between the two groups in our study may change with future reports on thrombosis outcomes, which could contribute to flap necrosis.

5 | Conclusions

Our study results confirmed that there is no difference in the risk of thrombosis or partial necrosis between neck vessels and the STA/V as recipient vessels in head and neck reconstruction. However, the risk of flap failure was significantly greater when the STA/V was used. On the basis of our results, some authors have reported good outcomes by performing proximal dissection of the STV to overcome vascular size mismatch. However, the meta-analysis results indicate that the probability of flap failure is greater when the STV is chosen as the recipient site than when the neck vessel is chosen. Considering these findings, surgeons should exercise caution when selecting the STV as the recipient site, and as some authors have suggested, proximal dissection may be necessary during surgery (Venkatesh et al. 2020). Furthermore, the STA/V is well known for its susceptibility to vasospasm, and unexpected postoperative adverse events can occur, making it necessary for more meticulous postoperative monitoring.

Author Contributions

Woo Shik Jeong conceived the study idea and wrote sections of the manuscript. Woonhyeok Jeong conceived the study idea, analyzed the data, wrote sections of the manuscript, and edited the figures.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

Abdelgadir, J., A. P. Haskell-Mendoza, A. R. Magno, et al. 2023. "Revisiting Flow Augmentation Bypass for Cerebrovascular Atherosclerotic Vaso-Occlusive Disease: Single-Surgeon Series and Review of the Literature." *PLoS One* 18: e0285982.

Andrades, P., E. L. Rosenthal, W. R. Carroll, C. F. Baranano, and G. E. Peters. 2008. "Zygomatic-Maxillary Buttress Reconstruction of Midface Defects With the Osteocutaneous Radial Forearm Free Flap." *Head & Neck* 30: 1295–1302.

Ausen, K., and I. Pavlovic. 2011. "Flaps Pedicled on the Superficial Temporal Artery and Vein in Facial Reconstruction: A Versatile Option With a Venous Pitfall." *Journal of Plastic Surgery and Hand Surgery* 45: 178–187.

Chung, S. W., I. H. Byun, and W. J. Lee. 2019. "Sequential Reconstruction for Recurrent Head and Neck Cancer: A 10-Year Experience." *Archives of Plastic Surgery* 46: 449–454.

DerSimonian, R., and N. Laird. 1986. "Meta-Analysis in Clinical Trials." *Controlled Clinical Trials* 7: 177–188.

Halvorson, E. G., P. G. Cordeiro, J. J. Disa, E. F. Wallin, and B. J. Mehrara. 2009. "Superficial Temporal Recipient Vessels in Microvascular Orbit and Scalp Reconstruction of Oncologic Defects." *Journal of Reconstructive Microsurgery* 25: 383–387.

Hansen, S. L., R. D. Foster, A. S. Dosanjh, S. J. Mathes, W. Y. Hoffman, and P. Leon. 2007. "Superficial Temporal Artery and Vein as Recipient Vessels for Facial and Scalp Microsurgical Reconstruction." *Plastic and Reconstructive Surgery* 120: 1879–1884.

Higgins, J. P. T., D. G. Altman, and J. A. C. Sterne, eds. 2017. "Assessing Risk of Bias in Included Studies." In *Cochrane Handbook for Systematic Reviews of Interventions Version 5.2.0*, edited by J. P. T. Higgins, R. Churchill, J. Chandler, and M. S. Cumpston. London, UK: Cochrane.

Iida, T., H. Yoshimatsu, T. Yamamoto, and I. Koshima. 2016. "A Pilot Study Demonstrating the Feasibility of Supermicrosurgical End-to-Side Anastomosis Onto Large Recipient Vessels in Head and Neck Reconstruction." *Journal of Plastic, Reconstructive & Aesthetic Surgery* 69: 1662–1668.

Las, D. E., T. de Jong, J. M. Zuidam, N. M. Verweij, S. E. Hovius, and M. A. Mureau. 2016. "Identification of Independent Risk Factors for Flap Failure: A Retrospective Analysis of 1530 Free Flaps for Breast, Head and Neck and Extremity Reconstruction." *Journal of Plastic, Reconstructive & Aesthetic Surgery* 69: 894–906.

Li, J., Y. Shen, L. Wang, J. B. Wang, J. Sun, and T. W. Haugen. 2018. "Superficial Temporal Versus Cervical Recipient Vessels in Maxillary and Midface Free Vascularized Tissue Reconstruction: Our 14-Year Experience." *Journal of Oral and Maxillofacial Surgery* 76: 1786–1793.

Lin, P. Y., R. Miguel, K. Y. Chew, Y. R. Kuo, and J. C. Yang. 2014. "The Role of the Anterolateral Thigh Flap in Complex Defects of the Scalp and Cranium." *Microsurgery* 34: 14–19.

Meleca, J. B., R. P. Kerr, B. L. Prendes, and M. A. Fritz. 2021. "Anterolateral Thigh Fascia Lata Rescue Flap: A New Weapon in the Battle Against Osteoradionecrosis." *Laryngoscope* 131: 2688–2693.

Moreno, M. A., R. J. Skoracki, E. Y. Hanna, and M. M. Hanasono. 2010. "Microvascular Free Flap Reconstruction Versus Palatal Obturation for Maxillectomy Defects." *Head & Neck* 32: 860–868.

Nahabedian, M. Y., N. Singh, E. G. Deune, R. Silverman, and A. P. Tufaro. 2004. "Recipient Vessel Analysis for Microvascular Reconstruction of the Head and Neck." *Annals of Plastic Surgery* 52: 148–155. discussion 156–147.

Panje, W. R., and M. R. Morris. 1991. "The Temporoparietal Fascia Flap in Head and Neck Reconstruction." *Ear, Nose, & Throat Journal* 70: 311–317.

Philips, R., M. C. Topf, A. Graf, et al. 2019. "Orbital Outcomes After Orbit-Sparing Surgery and Free Flap Reconstruction." *Oral Oncology* 98: 78–84.

Revenaugh, P. C., M. A. Fritz, T. M. Haffey, R. Seth, J. Markey, and P. D. Knott. 2015. "Minimizing Morbidity in Microvascular Surgery: Small-Caliber Anastomotic Vessels and Minimal Access Approaches." *JAMA Facial Plastic Surgery* 17: 44–48.

Saleki, M., M. A. Noor, P. Hurt, and A. Abul. 2023. "Full-Thickness Skin Graft Versus Split-Thickness Skin Graft for Radial Forearm Free Flap Transfer in Oral Cavity Reconstruction: A Systematic Review and Meta-Analysis." *Cureus* 15: e49279.

Scaglioni, M. F., P. J. Kuo, Y. C. Chen, P. Y. Lin, and Y. R. Kuo. 2016. "The New Innovation of the Lower Medial Thigh Perforator Flap for Head and Neck Reconstruction." *Microsurgery* 36: 284–290.

Shimizu, F., M. P. Lin, M. Ellabban, G. R. Evans, and M. H. Cheng. 2009. "Superficial Temporal Vessels as a Reserve Recipient Site for Microvascular Head and Neck Reconstruction in Vessel-Depleted Neck." *Annals of Plastic Surgery* 62: 134–138.

Sousa, B. A., F. L. Dias, M. A. A. de Sousa, M. A. Pinto, J. M. Silva, and C. R. Cernea. 2023. "Recipient Vessels for Free Flaps in Advanced Facial Oncologic Defects." *Brazilian Journal of Otorhinolaryngology* 89: 101271.

Tamaki, A., and C. A. Zender. 2023. "Free Flap Donor Sites in Head and Neck Reconstruction." *Otolaryngologic Clinics of North America* 56: 623–638.

Tan, N. C., P. Y. Lin, Y. C. Chiang, et al. 2014. "Influence of Neck Dissection and Preoperative Irradiation on Microvascular Head and Neck Reconstruction-Analysis of 853 Cases." *Microsurgery* 34: 602–607.

Triana, R. J., Jr., V. Uglesic, M. Virag, et al. 2000. "Microvascular Free Flap Reconstructive Options in Patients With Partial and Total Maxillectomy Defects." *Archives of Facial Plastic Surgery* 2: 91–101.

Venkatesh, V., M. Fracol, S. Turin, M. Ellis, and M. Alghoul. 2020. "Utilization of Intraparotid Segments of Superficial Temporal Vessels for Head and Scalp Free Flap Microanastomosis: A Clinical, Histological, and Cadaveric Study." *Journal of Reconstructive Microsurgery* 36: 253–260.

Vos, D. J., K. Arianpour, M. A. Fritz, et al. 2024. "Minimally Invasive Approach to Access Vessels for Microvascular Anastomosis in Head and Neck Reconstruction." *Laryngoscope* 134: 2177–2181.

Yang, S., J. W. Hong, I. S. Yoon, D. H. Lew, T. S. Roh, and W. J. Lee. 2021. "Anterolateral Thigh Free Flaps and Radial Forearm Free Flaps in Head and Neck Reconstruction: A 20-Year Analysis From a Single Institution." *Archives of Plastic Surgery* 48: 49–54.

Yano, T., K. Tanaka, H. Iida, S. Kishimoto, and M. Okazaki. 2012. "Usability of the Middle Temporal Vein as a Recipient Vessel for Free Tissue Transfer in Skull-Base Reconstruction." *Annals of Plastic Surgery* 68: 286–289.

Yazar, S., F. C. Wei, H. C. Chen, et al. 2005. "Selection of Recipient Vessels in Double Free-Flap Reconstruction of Composite Head and Neck Defects." *Plastic and Reconstructive Surgery* 115: 1553–1561.