Review Article

Keystone Flap Reconstruction in Skin Cancer and Soft Tissue Defects: A Scoping Review of Versatility, Safety and Outcomes

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ABSTRACT

Background: We aimed to evaluate the versatility, safety and wide clinical applications of the keystone flap in reconstruction following skin cancer excision and in soft tissue defects of varying sizes across the head, neck, limbs and trunk, with respect to aesthetic and functional outcomes.

Methods: A scoping review of published literature was undertaken in accordance with PRISMA-ScR guidelines. PubMed, ScienceDirect and Google Scholar were searched. The initial focus was on keystone flap reconstruction following melanoma excision. However, due to limited melanoma-specific data, the inclusion criteria were expanded to include studies involving all skin cancers, including squamous cell carcinoma and basal cell carcinoma, as well as broader reconstructive applications of the keystone flap in soft tissue defects to enable a more comprehensive evaluation of outcomes.

Results: Seventeen studies published between 2003 and 2024 were included. Keystone flaps were most utilised in lower limb reconstruction following oncological excision and soft tissue defect reconstruction across multiple anatomical sites. Complication rates ranged from 0% to 38.8%, with the majority classified as minor and managed conservatively. Reported outcomes demonstrated high success rates and favourable cosmetic and functional results. No standardised patient-reported outcome measures were employed across the included studies.

Conclusion: The keystone flap appears to be a versatile and reliable reconstructive option with broad applications across defects of varying sizes and anatomical sites. The available evidence suggests it may serve as an effective alternative to conventional flaps and grafts in skin cancer and soft tissue reconstruction. However, findings are derived predominantly from retrospective case series and thus should be interpreted accordingly, with prospective comparative studies warranted to further validate these outcomes.

KEYWORDS
Keystone flap; Perforator flap; Skin neoplasm; Melanoma; Soft tissue injuries; Reconstructive surgical procedures

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INTRODUCTION

Skin cancer represents one of the most prevalent cancers worldwide, with surgical excision remaining the mainstay of curative treatment [1]. Wide local excision is the primary excision method, undertaken to achieve clear histological margins. This frequently produces cutaneous defects that are not amenable to direct primary closure, particularly in anatomically challenging regions such as the lower limbs, trunk, and periarticular zones. The reconstructive management of such defects poses considerable challenges. Skin grafting, whilst widely used, carries risks of donor site morbidity, prolonged healing, and suboptimal aesthetic outcomes including occasionally poor colour and contour match with the surrounding tissue [2]. Conventional local and regional flaps may address some of these limitations but often require complex dissection, the sacrifice of certain vessels or the creation of a distant donor defect [3].

The keystone design perforator island flap, first described by Felix Behan in 2003, was proposed as an alternative reconstructive option for cutaneous defects arising from skin cancer excision [4]. The flap takes its name from its resemblance to the wedge-shaped keystone of the Roman arch and is designed as a curvilinear trapezoidal island of skin and subcutaneous tissue that preserves the underlying fasciocutaneous and musculocutaneous perforators within its subcutaneous base. Unlike conventional local flaps, the keystone flap requires no undermining which maintains the integrity of the perforating arterial supply and limits disruption to the surrounding soft tissue. Behan originally classified the flap into four types (types I to IV), with type II further subdivided into IIA and IIB depending on whether skin grafting of the donor site was required [4].

Since its introduction, the keystone flap has attracted growing interest across reconstructive surgery. Its technical simplicity, reproducibility, and versatility across multiple anatomical sites have led to its application in a broad range of clinical contexts beyond its original indication, including soft tissue reconstruction following trauma, irradiated tissue defects, and non-oncological wounds [5]. In regions where skin extensibility is limited or where wound contracture may impair function, such as the periarticular surfaces of the elbow, knee and Achilles's tendon, the keystone flap has demonstrated tension-free closure without the risks of graft failure or donor-recipient colour mismatch [6].

Despite the growing body of clinical evidence, the evidence base for keystone flap reconstruction remains largely composed of retrospective case series and single-centre reports, with limited prospective data and heterogeneous outcome reporting. No comprehensive scoping review has systematically evaluated the versatility, safety, and outcomes of the keystone flap specifically in the context of skin cancer excision and soft tissue defect reconstruction across anatomical sites.

We aim to evaluate the clinical applications, complication rates, functional and aesthetic outcomes, and oncological safety of the keystone flap across published literature from 2003 to 2024, with a view to support its integration into reconstructive practice following skin cancer excision and in soft tissue defects.

METHODS

This scoping review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines as demonstrated in Figure 1.

Search strategy

Searches were conducted across PubMed, ScienceDirect, and Google Scholar to identify relevant literature published from 2003 onwards. The following search string was applied across all three databases using Boolean operators:

("keystone flap" OR "keystone perforator island flap" OR "keystone design perforator island flap" OR "surgical flaps" MeSH Terms) AND ("skin cancer" OR "melanoma" OR "squamous cell carcinoma" OR "basal cell carcinoma" OR "soft tissue defect" OR "oncological excision" OR "reconstruction").

Searches were last conducted on 22nd July 2026. Study selection is summarised in the PRISMA flow diagram (Figure 1). This scoping review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines [7].

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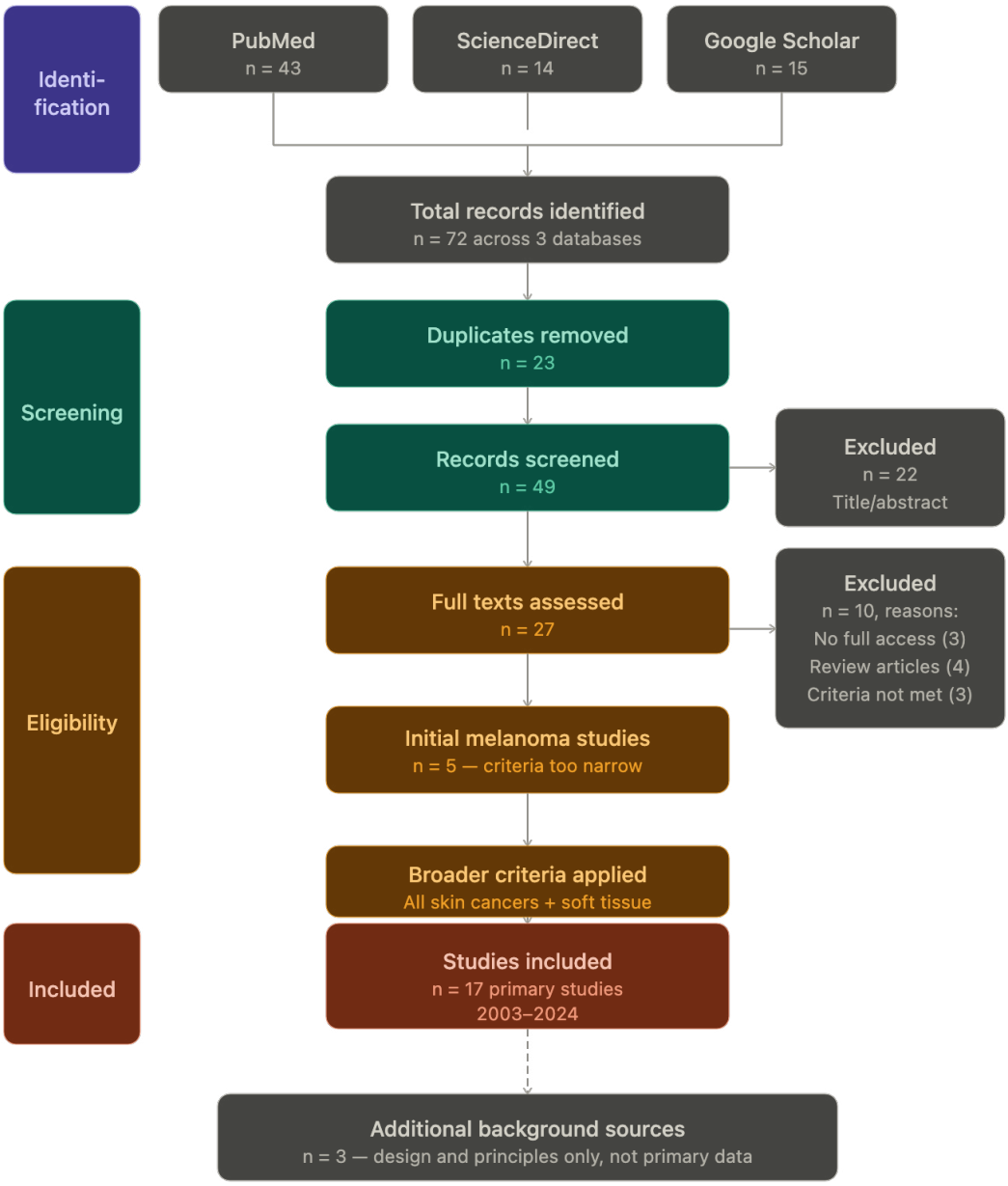

Fig. 1. Search strategy demonstrated in PRISMA diagram

Inclusion and exclusion criteria

Initially, studies reviewing the application of the keystone flap following melanoma excision were included, encompassing all anatomical sites including the head, neck, trunk, and limbs. Due to the limited number of publications specifically addressing this indication (n = 5), the inclusion criteria were broadened to incorporate studies evaluating keystone flap reconstruction in other skin cancers including squamous cell carcinoma and basal cell carcinoma as well as wider reconstructive contexts such as irradiated tissue and non-oncological soft tissue defects. This approach was undertaken to provide a more comprehensive evaluation of the flap's versatility, safety, and clinical applicability.

Studies were eligible for inclusion if they reported primary outcome data on keystone flap reconstruction in patients of any age or sex, published between 2003 and 2024. Duplicate studies (n = 23), unpublished grey literature, review articles,

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and studies without full-text access were excluded. Title and abstract screening were conducted by a sole reviewer against the predetermined inclusion and exclusion criteria.

Data extraction

Data were extracted by a single reviewer and recorded in Microsoft Excel. Extracted variables included study design, aim, sample size, patient age range, lesion type, lesion size, Breslow thickness where reported, anatomical location, complications, and overall conclusions.

All title, abstract and full-text screenings were carried out by one reviewer (TA). This was a practical limitation of this scoping review, as the project was conducted independently without access to a second reviewer. As only one person screened the studies, there was a risk that relevant studies may have been missed or inappropriate studies included, based on the reviewer's existing knowledge of the topic. To reduce this risk, all screening decisions were made using pre-agreed inclusion and exclusion criteria. In addition, a consultant plastic and reconstructive surgeon (AM) independently reviewed and approved the final list of included studies and the completed manuscript before submission.

No formal quality assessment was carried out on the included studies. This is a limitation of the review, as without using a recognised appraisal tool, such as the NIH Quality Assessment Tool [8] or ROBINS-I [9], it is not possible to formally judge the quality of each individual study. Some studies may therefore be of higher or lower methodological quality than others, and this should be kept in mind when interpreting the findings of this review.

RESULTS

The data outcomes analysed in this review were varied, consisting of the complications, outcomes, patient satisfaction, recurrence rate and time to follow up.

The characteristics and key findings of the 17 included studies are summarised in Table 1.

Complications

The occurrence of minor and major complications was studied, with a range of recurrence rates reported from 0.3% to 38.8%, apart from six which failed to report on a complication rate. Minor complications identified included wound edge dehiscence, local cellulitis, seroma, delayed wound healing and minor infection. On the other hand, major complications included flap separation, partial/complete flap loss, partial or complete flap necrosis and surgical site infections (SSI) requiring debridement.

Complications were separated into minor and major categories based on their clinical significance and subsequent management post-operatively. In this scoping review, minor complications were defined as those resolving with conservative measures and without compromise to flap viability, whereas major complications were defined as events requiring surgical intervention or resulting in either partial or full necrosis or total flap loss. The complications reported across included studies are summarised in Table 2.

Complication rates range from 0% (Gordon et al. [14]) to 38.8% (Aragón-Miguel et al. [11]). Eleven studies reported minor complications, of which nine were not accompanied by any major complications. Two studies reported both minor and major complications. Major complications, including partial or complete flap necrosis, occurred in fewer than 5% of cases across those studies that reported them (Behan [5]; Franco et al. [16]). Minor complications included wound edge dehiscence, superficial infection, seroma, delayed wound healing and local cellulitis. Six studies did not report a complication rate. The highest reported complication rate of 38.8% (Aragón-Miguel et al. [11]) should be interpreted with caution as the absolute number of complications was not explicitly stated and all events were classified as minor, with no flap loss described.

Outcomes

The review of literature highlighted a significant lack of qualitative summaries of patient-reported functional outcomes. Two cases report both clinician and patient satisfaction regarding the quality of functional and cosmetic outcomes, whilst another study reports favourable outcomes in all patients during the follow up period [6, 22]. Similarly, Behan [5] reported that satisfactory aesthetic outcomes were achieved post-operatively.

However, all three cases fail to identify individual

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Table 1: Characteristics and key findings of the seventeen included studies

Study	Study design	n	Indication /lesion type	Anatomical site	Follow-up	Key outcomes
Behan 2003 [4]	Case series	300	Skin cancer (mixed)	Multiple sites	NR	Introduced keystone flap; reliable low-morbidity reconstruction. Complication rate 0.3%
Behan et al., 2006 [5]	Case series	NR	Mixed; irradiated tissue	Multiple sites	NR	Viable alternative to free flaps in irradiated tissue; acceptable aesthetic outcomes
Moncrieff et al., 2008 [3]	Prospective case series	146	Primary melanoma	Leg	NR	Excellent cosmetic outcomes; supports keystone flap over skin grafting for leg melanoma. Complication rate 4.6%
Talev et al., 2016 [12]	Retrospective case series	61	Melanoma (non-head/neck)	Trunks, limbs	Mean 3.2 years	Safe and effective for melanoma WLE defects; 3% recurrence rates at 3.2 years. Complication rate 26% (minor only)
Pripotnev et al., 2017 [10]	Case series	39	Mixed skin cancers including SCC	Multiple sites including hand	NR	Practical and versatile; preserved ROM at 2 months. Complication rate 5%
Huang et al., 2017 [21]	Systematic review	NR	Mixed soft tissue defects	Lower extremity	Mean 15.3 ± 8.4 months	Reliable for lower extremity defects; low flap loss rates. Complication rate 9.6%
Jovic et al., 2017 [6]	Case series	5	Mixed skin cancers	Periarticular (elbow, knee)	NR	Optimal periarticular reconstruction; high patient satisfaction; avoids graft failure. Complication rate 20%
Behan 2018 [17]	Case series	28	Melanoma	Multiple sites including head	NR	Effective for melanoma reconstruction; necrosis in one smoker highlights patient selection importance. Complication rate 4%
Aragón-Miguel et al., 2018 [11]	Retrospective case series	18	Mixed skin cancers	Multiple sites	NR	Versatile in dermatology practice; highest complication rate in review (38.8%), all minor*
Rini et al., 2020 [18]	Systematic review	54	Mixed; trunk defects	Trunk	Median 35.3 months	Effective for trunk reconstruction; complications managed conservatively. Complication rate 35.2%
Yan et al., 2021 [15]	Retrospective case series	17	Oncological (mixed)	Back	Median 35.3 months (range 13.3–53.1 months	Reliable for back reconstruction; longest median follow-up in review. Complication rate 29%
Kong et al., 2021 [22]	Case series	6	Mixed skin cancers	Anterior lower leg	4.83 ± 1.17 months	Omega variation and Sydney modification effective for small-moderate anterior leg defects. Complication rate 17%
Gordon et al., 2022 [14]	Case series	NR	Skin cancer	Upper extremity	NR	Safe and effective for upper extremity skin cancer defects. Complication rate 0%
Hallock 2023 [19]	Case series	68	Mixed soft tissue defects	Lower extremity	NR	Ideal local flap for lower extremity; reproducible outcomes. Complication rate 6%
Huang et al., 2019 [23]	Retrospective case series	NR	Mixed skin tumours	Multiple sites	NR	Modified keystone flaps successfully applied following skin tumour ablation across multiple anatomical sites
Singh et al., 2024 [13]	Case series	16	Mixed skin cancers	Multiple sites	2-15 months	High surgeon and patient satisfaction; useful addition to dermatosurgeons' armoury
Franco et al., 2024 [16]	Prospective case series	100	Mixed skin cancers and soft tissue	Multiple sites including joints	NR	Largest prospective series; demonstrates versatility and maintained joint function. Complication rate 5%
Pawlak et al., 2024 [20]	Retrospective case series	12	Mixed skin cancers and soft tissue	Multiple sites	Median 7 weeks	Versatile clinical applications; shortest follow-up in review limited long-term assessment. Complication rate 33%

*Complication rate of 38.8% represents the highest reported in this review. The absolute number of complications was not explicitly stated in the original publication. All reported complications were minor; no flap loss or major complications were described.
NR = not reported. WLE = wide local excision. SCC = squamous cell carcinoma. ROM = range of motion

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Table 2: Complications in the seventeen included and reviewed studies

Reference	Number of complications	Complications	Description	Reported rate
Pripotnev et al., 2017 [10]	2 out of 39 cases	Minor	Partial flap dehiscence	5%
***Aragón-Miguel et al., 2018** [11]	Not reported	Minor	Infection, dehiscence and post-op bleeding	38.8%
Behan 2003 [4]	1 out of 300 cases	Major	Partial necrosis	0.3%
Talev et al., 2016 [12]	16 out of 61 cases	Minor	Flap separation, no flap loss	26%
Singh et al., 2024 [13]	3 out of 16 cases	None	No wound dehiscence of loss of flap, 3 cases of temporary neuropraxia	Not reported
Gordon et al., 2022 [14]	Not reported	None	No intraoperative or postoperative complications	Not reported
Jovic et al., 2017 [6]	1 out of 5 cases	Minor	Superficial wound infection post-operatively	20%
Yan 2021 [15]	5 out of 17 cases	Minor	Haematomas, SSI requiring debridement, superficial wound dehiscence, cellulitis, seroma	29%
Franco et al., 2024 [16]	5 out of 100 cases	Major	1 complete flap necrosis, 4 partial flap necrosis over bony prominences e.g. tibia and scalp	5%
Behan et al., 2006 [5]	Not reported	NR	Low complication rate but number not stated	Not reported
Behan 2018 [17]	1 out of 28 cases	Major	Distal flat necrosis in a smoker who underwent removal of a left forehead desmoplastic melanoma with KPIF of the superficial temporal artery	4%
Rini et al., 2020 [18]	19 out of 54 cases	Minor	Infection, wound dehiscence, delayed healing and partial flap loss	35.2%
Hallock 2023 [19]	4 out of 68 cases	Minor	Dehiscence along the lesser curvature of the keystone flap	6%
Pawlak et al., 2024 [20]	4 out of 12 cases	Minor	3 experienced minor wound dehiscence, 1 patient with a history of keloid formation developed a symptomatic scar which required excision	33%
Huang et al., 2017 [21]	Not reported	Minor and major	Partial flap loss (1.1%), complete flap loss (0.7%)	9.6%
Kong et al., 2021 [22]	1 out of 6 cases	Minor	1 marginal maceration	17%
Moncrieff et al., 2008 [3]	8 out of 146 cases	Minor and major	1 partial flap necrosis (0.7%) and 1 total flap loss (0.7%)	4.6%

*Complication rate of 38.8% represents the highest reported in this review. The exact number of complications was not explicitly stated in the original publication. All reported complications were minor and no flap loss or major complications were described

outcomes for their respective cohort of patients and whether they were able to restore a 'return to baseline functionality' post-keystone flap reconstruction. In the case series by Jovic et al. [6], which discusses the use of keystone flaps in periarticular wound closure where wound contractures can impair both flexion and extension at joints, this fails to mention whether patients were able to perform such motions with the same ease as prior to surgery.

Franco et al. [16] reported that the use of keystone flaps over joints at their flexion aspects e.g., elbow and popliteal fossa, nape and Achilles tendon, have proven to maintain functionality, but this provides minimal information as to whether functionality was returned to a patient's baseline or was slightly impaired post-procedure. Moncrieff et al. [3] reported that their prospective study looking into keystone flap reconstruction for primary melanoma excision defects of the leg highlights those immediate post-operative results demonstrate minor contour irregularity after inserting the flap but that this resolved rapidly by a combination of tissue creep and stress relaxation resulting in excellent cosmetic result of the flaps.

Follow-up time

Time for suture removal was excluded from this aspect of the review – only follow-up time to post-op review was included. None of the studies mentioned time to suture removal however follow-up time for post-op review was discussed and reviewed.

A total of seven cases didn't report follow-up time and those cases that detailed follow-up times are highlighted below in Table 3.

Only one study (Pawlak et al. [20]) reported a patient with a history of keloid formation who developed a symptomatic keloid scar requiring excision. Follow-up periods ranged from a median of 7 weeks (Pawlak et al. [20]) to 35.3 months (Yan et al. [15]).

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Table 3: Cases that reported post procedure follow-up time

Case	Time to follow-up
Singh et al. [13]	2-15 months
Gordon et al. [14]	Had follow-up appointments booked but time not stated
Jovic et al. [6]	3-18 months
Yan et al. [15]	13.3-53.1 months, median follow-up time was 35.3 months
Pawlak et al. [20]	Median follow-up time was 7 weeks
Huang et al. [21]	15.3 months ± 8.4 months
Kong et al. [22]	4.83 months ± 1.17 months

Patient satisfaction

Fourteen of the included studies (78%) did not report on patient satisfaction. Of the three studies that did, Singh et al. [13] reported that overall results were satisfying for both surgeons and patients, with no patients requesting scar revision. Jovic et al. [6] reported high levels of patient satisfaction with the appearance of operative sites. Kong et al. [22] reported that two of six patients expressed satisfaction with their surgical outcomes.

Recurrence

Two studies reported long-term recurrence outcomes [3, 12]. Moncrieff et al. [3] reported a recurrence rate of 0.6% and Talev et al. [12] reported a recurrence rate of 3% at a median follow-up of 3.2 years. Talev et al. [12] described two locoregional recurrences in detail – a 76-year-old woman with a pT3aN0 calf melanoma who developed an in-transit metastasis 3cm above the keystone flap suture line 16 months after excision, and a 46-year-old woman with a pT3aN1 calf melanoma who developed a local recurrence under the keystone flap suture line at one year, followed by multiple in-transit metastases throughout the leg two months later.

Keystone flaps and other reconstructive options

Skin defects arising from oncological resection or other causes require appropriate skin coverage. Whilst primary closure, rotational flaps, free flaps and skin grafting represent established reconstructive options, skin grafting carries potential for donor site morbidity, poor cosmesis and extended healing times [2]. The included literature demonstrates that the keystone flap offers good aesthetic outcomes, shorter healing times, ease of use and reproducibility across multiple anatomical sites with low complication rates. Maurichi et al. [23] noted that recurrence depends primarily on tumour factors and margin status, including Breslow thickness, ulceration and positive margins, rather than on the choice of reconstructive technique. Jovic et al. [6] identified the keystone flap as particularly effective for periarticular reconstruction, noting its ability to provide adequate tissue coverage whilst withstanding regional tensile pressure changes, reducing the risks of graft failure, contour defects and donor-recipient colour mismatch.

DISCUSSION

The consistently low complication rates reported across included studies suggest that the keystone flap is a reliable and reproducible technique, particularly in anatomically difficult areas such as the periarticular regions of the elbows and knees as reported in Jovic et al. [6]. This supports its use as a suitable reconstructive option across a range of skin cancer and soft tissue defect indications.

The findings of this review must be considered in the context of the available evidence, which is largely made up of retrospective case series. Whilst these studies have been useful in establishing the technique and recording early outcomes, they do not allow for direct comparison between reconstructive approaches or confident conclusions about what is driving the results. Randomised controlled trials, although difficult to conduct in the reconstructive setting, would provide stronger evidence by allowing direct comparison of keystone flaps with alternative options such as split-thickness skin grafting or primary closure, with consistent and standardised outcome measurement. A further gap identified in this review is the limited number of studies specifically examining keystone flap reconstruction

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following melanoma excision. Given melanoma's tendency to recur locally and metastasise and the long follow-up periods this requires, dedicated prospective studies are needed to establish the oncological safety of the keystone flap technique in this specific group of patients.

The wide range of complication rates observed across included studies, from 0% (Gordon et al. [14]) to 38.8% (Aragón-Miguel et al. [11]) most likely reflects differences in how complications were defined and reported across studies, rather than genuine differences in how well the flap performs. It is worth noting that the highest reported rate came from a study in which the total number of complications was not clearly stated, all events were minor and no flap loss or major complications occurred.

A key limitation of the available evidence is the considerable variation across included studies, which makes drawing firm comparative conclusions difficult. Firstly, differences in study design, ranging from prospective to retrospective case series and systematic reviews, mean that the quality of evidence varies considerably between studies, with retrospective designs being more prone to bias. Secondly, differences in how complications were defined make it unreliable to compare complication rates directly across studies. Without an agreed classification system, individual studies used different thresholds for what counted as a minor or major complication, which likely explains the wide range of rates reported. Thirdly, differences in outcome measures reflect the lack of a standardised reporting framework in the keystone flap literature. Few studies used validated patient-reported outcome measures, and follow-up periods ranged from seven weeks to 35.3 months, making it difficult to draw meaningful conclusions about long-term functional and aesthetic outcomes. Agreeing on a core set of outcomes, including how complications are classified, how function is measured, and how patient satisfaction is assessed, would make future studies much more comparable and useful.

Much of the current evidence therefore remains descriptive rather than analytical. Future studies would benefit from measuring long-term function, appearance, patient satisfaction at regular intervals and tissue flexibility in periarticular reconstructions, all of which are important markers of reconstructive success, to build a more complete picture of how keystone flaps perform not just in terms of flap viability, but in terms of the patient's overall quality of life.

Future research in keystone flap reconstruction should prioritise prospective multicentre studies with standardised outcome reporting. Agreement on a core outcome set, covering complication classification, functional measures, validated patient-reported outcomes and aesthetic assessment tools is needed to allow meaningful comparison across future studies. Randomised controlled trials comparing keystone flap reconstruction with split-thickness skin grafting and primary closure would provide the strongest evidence to guide clinical decision-making. In the context of melanoma specifically, studies with longer follow-up periods in line with oncological surveillance requirements are particularly needed to confirm the long-term safety of the technique.

Limitations

A key limitation of this scoping review is that no formal quality assessment was carried out on the included studies. Most included studies are retrospective case series, which are prone to selection bias, reporting bias and confounding. Without using a recognised appraisal tool such as the NIH Quality Assessment Tool [8] or ROBINS-I [9], it is not possible to give greater weight to higher quality studies or formally exclude those of poor quality. This should be kept in mind when interpreting the findings of this review.

Publication bias is a further limitation. Studies reporting positive outcomes are more likely to be published than those reporting poor results or technique failure. As a result, the findings of this review may reflect a positively skewed picture of keystone flap reconstruction, and the true complication and failure rates may be higher than those reported here.

Language bias should also be noted. Searches were conducted in English only, meaning studies published in other languages may have been missed. This could exclude relevant data from non-English speaking countries where the technique may be used differently or with different outcomes.

The follow-up periods reported across most included studies were short, limiting the ability to identify complications that develop later, such as hypertrophic scarring, keloid formation, wound

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contractures and sensory deficits. This is especially relevant in melanoma reconstruction, where longer follow-up is needed given the risk of local recurrence and metastasis. Future studies should use follow-up periods that align with oncological surveillance requirements.

All title, abstract and full-text screenings was carried out by one reviewer (TA). Single-reviewer screening carries a greater risk of selection bias and human error than a two-person reviewer process, as there is no second reviewer to identify and resolve disagreements in the selection process. The use of pre-agreed inclusion and exclusion criteria and oversight by a senior co-author (AM) helped to reduce this risk, but the possibility of unintentional bias in study selection cannot be fully ruled out. Future scoping reviews in this area should aim to use two independent reviewers to improve the robustness of the study selection process.

Finally, the considerable variation across included studies in terms of study design, complication definitions and outcome measures limit the ability to draw strong comparative conclusions and makes pooling of data for meta-analysis inappropriate.

CONCLUSION

The available literature suggests that keystone flap reconstruction is associated with consistently low complication rates, reliable wound healing and good aesthetic and functional outcomes following skin cancer excision and soft tissue defect reconstruction. The technique achieves tension-free closure with minimal impact on the donor site and most reported complications were minor and resolved without surgical intervention. The fact that these outcomes have been reproduced across multiple anatomical sites and by surgeons of varying experience suggests that the technique is both robust and widely applicable.

Although most of the available evidence comes from retrospective case series and single-centre studies, the consistency of findings across different patient groups and anatomical locations suggests that the keystone flap may be a reliable and valuable reconstructive option following skin cancer excision and in the management of soft tissue defects, particularly where primary closure is not possible. However, given the limitations of the current evidence, these findings should be interpreted with caution and do not yet justify recommending the keystone flap as a routine first-line reconstructive option.

Several gaps in the evidence limit the strength of these conclusions. Prospective multicentre studies with standardised outcome reporting, validated patient-reported outcome measures and longer follow-up periods are needed to better understand the long-term functional, aesthetic and oncological outcomes of keystone flap reconstruction. Studies specifically examining the technique following melanoma excision, a cancer with a high risk of recurrence and a need for prolonged follow-up, are particularly needed to confirm its oncological safety, with only two studies in this review reporting long-term recurrence outcomes [3,12]. Randomised controlled trials comparing keystone flap reconstruction with alternatives such as split-thickness skin grafting would provide the strongest evidence and allow direct comparison of outcomes.

Within the current limitations of the literature, the keystone flap warrants broader consideration in skin cancer excision and soft tissue defect reconstructive practice, with future high-quality research needed to build a stronger long-term evidence base.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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