International Surgery Journal
Pasham PG et al. Int Surg J. 2023 May;10(5):904-911
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20231389

Systematic Review

Comparison of the incisions used in neck dissection for oral squamous cell carcinoma: a systematic review

Pavan Goud Pasham[1]*, Manoj Ananthappan[2], James S. Jesudasan[3], Surya Rao Rao Venkata Mahipathy[2]

[1]Department of General Surgery, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Tamil Nadu, India
[2]Department of Plastic and Reconstructive Surgery, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Tamil Nadu, India
[3]Department of Oral and Maxillofacial Surgery, Sri Venkateswara Medcity, Tamil Nadu, India

Received: 07 April 2023
Revised: 14 April 2023
Accepted: 19 April 2023

***Correspondence:**
Dr. Pavan Goud Pasham,
E-mail: pavangoud2323@gmail.com

ABSTRACT

Oral cancers are a significant disease group with more than 404,000 new cases worldwide in 2002. The most common cancer of the oral cavity is the squamous cell carcinoma; constituting 95%. The 5-year survival is around 50%. Surgery can be combined with any combination of radiotherapy, chemotherapy and immunotherapy. Spread of the tumour to the cervical nodes is an early and consistent event in the natural history. The extent of cervical involvement is reflected in the staging of the tumour and has prognostic implications. Surgical dissection of the cervical lymph nodes at risk of metastasis may be undertaken as part of the management of the primary tumour. This may be accomplished by classic radical neck dissections, supra ohmohyoid neck dissection, selective neck dissection etc. The aim of the present review is to compare the clinical efficacy, the postoperative complications and the aesthetic outcome of the various incisions used in neck dissection for squamous cell carcinoma. A total of six comparative studies and randomized control studies were included in this systematic review, out of a total of 175 articles yield following the search strategy, from PubMed and Mesh databases. The incisions were compared for access, healing and cosmetic outcome. Trifurcate incisions (‘Y ’incision) were found to have the maximum incidence of wound dehiscence. The apron incision has no reported wound dehiscence and has been described as a robust flap. As far as cosmetics and access as a whole is concerned the reversed hockey stick incision is superior.

Keywords: Lymph node dissection, Oral squamous cell carcinoma, Incisions

INTRODUCTION

Squamous cell carcinoma is a malignant neoplasm, which is one of the major causes for morbidity and mortality the world over. As far as the aetiology is concerned, there is absolutely no doubt that on a global scale the abuse and use of tobacco products is the major cause for oral cancer. Alcohol use synergizes with tobacco as a risk factor. We now also know that many viruses also contribute to the multistep process of carcinogenesis in many neoplasms. Examples of those viruses thought to be involved are HSV (Herpes Simplex Virus), HPV (Human Papilloma Virus) etc. The ultimate goals of treatment of cancer of the oral cavity are excision of the cancerous mass, preservation and restoration of form and function and minimizing the sequlae of treatment.

The currently available means to achieve these ends are surgery, radiotherapy, chemotherapy, a combined approach and life style changes. In the surgical approach,

apart from management of the primary lesion it is important to address cervical lymph node metastasis. The presence of cervical metastasis can reduce the survival rate by 50%.[5] Historically neck metastasis has been addressed in the form of neck dissections, based on TNM staging of tumour. One of the first to mention an incision of the neck in connection with a tumour of the mouth was Regnoli, of Pisa. He described a 'T 'shaped incision made under chin for removal of a carcinomatous tongue. As neck dissections became an accepted and necessary part of treatment a variety of incisions were introduced to approach the cervical lymph nodes. Some of these are currently in use; others have undergone modifications while still others are of historical interest alone. No specific incision has received universal acceptance. The choice of incision depends on the surgeon's skill and technical philosophy.

Pico analysis

Patients-oral squamous cell carcinoma patients who have/have not been previously irradiated, intervention-neck dissection, comparison-Incisions used for neck dissection, outcomes-Healing, access and cosmetic outcome, outcome measures: healing, access, cosmetic result.

METHODS

Study conducted from the January-March 2023.

Study design

Systematic review used study design.

Inclusion criteria

The titles of the articles and the abstracts were reviewed. Articles in which the incisions for neck dissection for squamous cell carcinoma were evaluated and were selected for further review. The types of articles included in this review are comparative studies, randomized control trial, technical notes, case series, human trials and studies published in the English language

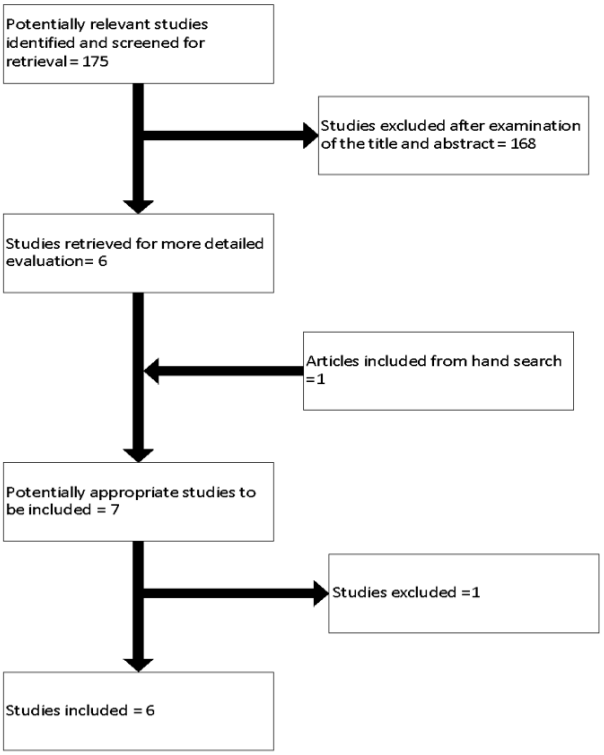

Figure 1: Search flowchart.

Variables of interest were healing, access and comesis.

Types of studies

Study population: Patients with oral squamous cell carcinoma with palpable lymph nodes

Type of intervention: Excision of the primary lesion combined with neck dissection for the lymph nodes.

Type of outcome measures: Primary outcome measure: Wound dehiscence.

Secondary outcome measures: Access to the surgical field and cosmetic result of the incision.

Table 1: Quality assessment of included studies.

Citation	Method of randomization	Allocation concealment	Outcome assessors blinded to intervention	Completeness of follow up
Ngi-Wieh et al[6]	No	No	No	Yes
Omura et al[7]	No	No	No	No
Lasardis et al[8]	No	No	No	No
Myssiorek[11]	No	No	No	No
Dissenyaka[9]	No	No	No	No
Gratz et al[10]	No	No	No	No

Data extraction and analysis

Once a final conclusion was reached regarding the articles to be reviewed, data was extracted from each article and tabulated. This was later cross checked. A quality assessment of the studies was then done.

The quality assessment of the included trials was undertaken independently as a part of data extraction process. Four main quality criteria were examined: Method of the randomization, allocation concealment, outcome assessors blinded to intervention and completeness of follow up (was there a clear explanation for withdrawals and dropouts in each treatment group). All these criteria were assessed and recorded as yes if adequate, no if inadequate.

RESULTS

A total of 175 articles were identified in the initial step of systematic literature search. After exclusion 6 articles which fit the selection criteria were included in this study. This study includes 4 comparative study, 1 case series and 1 technical note. In this systematic review, different incisions to access the various lymph nodes mentioned above were assessed along with their post-operative healing course and the cosmetic result.

Ngi-Wieh et al assessed 184 incisions for neck dissection. None of the 74 apron flap incisions showed any evidence of wound dehiscence. This stands true for both irradiated as well as non-irradiated patients.[9] The Mac-Fee incision on the other hand showed 8% wound dehiscence (2 out of 25 patients showed wound dehiscence). In the two patients, the wound dehiscence was relatively minor and healed uneventfully with dressings. Both were patients who were previously irradiated. The "Y" incision had 10.6% wound dehiscence (9 incisions showing wound dehiscence out of a total of 85). Of the 9 patients with wound dehiscence, 6 had pervious radiotherapy. There was reported wound dehiscence at the critical point where the 3 flaps interdigitate. According to the authors this can lead to exposure of the underlying carotid artery with the potential to lead to a carotid blow out.

Omura et al conducted a study on 43 patients divided into 5 groups. Of the 5 groups he found, the hockey stick incision provided the best cosmetic result as the suture lines were hidden by hair or clothing.[7] Surgical access however was lacking in the hockey stick incision requiring active retraction of the flap in order to explore the submental region. The reversed hockey stick incision, in this respect, fares better according to the author where access can be gained without actively retracting the flap. The main drawback of the reversed hockey stick incision appears to be the potential for marginal necrosis at the apex of the flap. These two basic incisions can be modified according to the clinical requirement and operator's judgement to include a contra laterally extended reversed hockey stick incision, an upwardly extended reversed hockey stick incision or a bilateral hockey stick incision. The principles of these modifications incisions remain the same.

Lasaridis et al in their study on 23 previously irradiated patients conclude that in terms of healing and access, the Conley and the modification of the Conley incision are superior to the classic Y incision and the Mac-Fee incision.[8] The three point junction of incisions did not seem to affect wound healing of the flaps which is contradictory to the results of other authors. Dissanayaka in his study on 33 patients with the single flap for neck dissection reports adequate access and exposure all the way up to the sternal incision of the sternomastoid.[9] Three patients showed necrosis of the flap in the area below the ear. Gratz et al in their study on 42 patients using the unilateral hockey stick incision reported 12% wound dehiscence, that is to say, 5 /42 patients presented with wound dehiscence.[10]

Myssiorek in his study on 109 patients with squamous cell carcinoma on whom a single transverse incision or its modification was used for neck dissection reported adequate access, no instances of post-operative skin necrosis despite pre-operative radio therapy, 3 patients with wound dehiscence (7%) but none significant enough to expose the carotid artery.[11]

From the graph presented in Figure 4 we can see that the apron flap and the Conley incision have the best wound healing although the cosmetic superiority of the apron flap is not mentioned. The reversed hockey stick incision has the best access and cosmetic result although 3 cases of minor wound dehiscence have been reported.

Table 2 : Description of individual studies.

Reference	Study description	N	Distribution of patients	Parameters assessed	Statistical analysis	Results
Use of apron flap incision for neck dissection **Ngi-Wieh et al[6]**	Comparative study	166	Triradiate incision: 85 Modified Mac Fee incision: 25 Apron incision: 74	Wound dehiscence Effect of irradiation on wound dehiscence	Fischer's exact test Yates Chi square test	Incidence of wound dehiscence statistically significant difference in incidence between triradiate and apron incision (p=0.004). Statistically Insignificant difference in incidence

Continued.

Reference	Study description	N	Distribution of patients	Parameters assessed	Statistical analysis	Results
						between Apron and Mac Fee incision (p=0.06). Effect of irradiation on wound healing statistically significant for triradiate (p=0.005), Significant increase for others (p=0.02).
Comparison between hockey stick and reversed hockey stick incision: gently curved single linear neck incisions for oral cancer, Bukawa[7]	Comparative study	43	Hockey stick incision (HSI):10 Reversed hockey stick incision (RHSI): 22 Modifications of above bilateral hockey stick incision: 3 Upwardly extended Hockey stick incision:3 Contrallateraly extended hockey stick incision: 5	Access (exposure of operating field) Viability of skin flap Cosmetic result	None	Access: Both HSI and RHSI provided good access. HSI involved difficulty in accessing submental lymph nodes Viability of skin flap: RHSI showed 2 cases of marginal necrosis. HSI showed no necrosis Cosmetic results: Both incisions showed good
Modification of the Conley incision for neck dissection Nicolas, Dalabirias[8]	Comparative study	23	Y incision: 5 Classic Conley Incision: 6 Macfee: 1 Modified Conley Incision: 11	Surgical Access Healing Cosmetic Result	None	Access: Classic Mac-fee showed difficult access to the surgical field Healing: 60% of patients with Y incision showed necrosis
A modified single flap for neck dissection in oral cancer Dissanayaka[9]	Case series	33	Modified single flap for neck dissection: 33	Healing cosmetic result	None	Healing: 3 out of 33 patients showed wound dehiscence. Cosmetic results: excellent
Unilateral hockey stick incision for neck dissection in oral carcinoma-technical note Gratz [10]	Technical note	42	Unilateral hockey stick:42	Surgical Access Healing Cosmetic Result	None	Surgical Access: Good He align: 5 out of 42 patients showed wound dehiscence cosmetic result: adequate
Extended single transverse neck incision for composite resections: does it work? Myssiorek[11]	Case series	109	Multicenter trial Group 1: 68 Group 2: 41	Surgical Access Healing Cosmetic Result	None	Surgical access: adequate Healing: No wound dehiscence. Cosmetic result: excellent

Table 3: Levels of evidence of included studies.

Author	Year	Study design	Level of evidence
Ngi-wieh et al[6]	1998	Comparative study	III-2
Omura et al[7]	1998	Comparative study	III-2
Lasaridis et al[8]	1994	Comparative study	III-2
Dissanyaka et al[9]	1990	Case series	IV
Gratz et al[10]	1994	Technical Note	IV
Myssiorek et al[11]	1991	Comparative study	III-2

Table 4: Variables of interest-wound dehiscence.

Author name	Incision type	N	Wound dehiscence, n (%)
Ngi-Wieh et al[6]	Apron flap incision	74	0 (0)
	Triradiate flap incision	85	9 (10.6)
	MacFee incision	25	2 (8)
Omura et al[7]	Hockey stick incision	10	0 (0)
	Reversed hockey stick incision	22	2 (9.09)
Lasaridis et al[8]	Mac Fee	1	0 (0)
	Conley	6	0 (0)
	Modified conley	11	0 (0)
	Y	5	3 (60)
Dissanyaka et al[9]	Modified single flap	33	3 (9.09)
Gratz et al[10]	Unilateral hockey stick	42	5 (12)
Myssiorek et al[11]	Extended single transverse	109	Not available

Table 5: Variables of interest-access to lymph nodes.

Author name	Incision type	Access
Ngi-Wieh et al[6]	Apron flap incision	Adequate
	Triradiate flap incision	Excellent
	Mac-Fee incision	Poor
Omura et al[7]	Hockey stick incision	Good
	Reversed hockey stick incision	Excellent
Lasaridis et al[8]	Mac fee	Poor
	Conley	Good
	Modified Conley	Adequate
	Y	Not mentioned
Dissanyaka et al[9]	Modified single flap	Not mentioned
Gratz et al[10]	Unilateral Hockey stick	Good
Myssiorek et al[11]	Extended single transverse	Adequate

Table 6: Scale.

Scale used	
Poor	1
Adequate	2
Good	3
Excellent	4
Not mentioned	#NA

Table 7: Variables of interest cosmesis.

Author name	Incision type	Cosmetic results
Ngi-wieh et al[6]	Apron flap incision	Not mentioned
	Triradiate flap incision	Not mentioned
	MacFee incision	Not mentioned
Omura et al[7]	Hockey stick incision	Good

Continued.

Author name	Incision type	Cosmetic results
	Reversed Hockey stick incision	Good
Lasaridis et al[8]	Macfee	Not mentioned
	Conley	Not mentioned
	Modified Conley	Excellent
	Y	Not mentioned
Dissanyaka et al[9]	Modified single flap	Excellent
Gratz et al[10]	Unilateral Hockey stick	Good
Myssiorek et al[11]	Extended single transverse	Excellent

Table 8: Assessment of methodological quality.

Study	Randomization	Allocation concealed	Assessor blinding	Drop outs described	Risk of bias
Ngi-wieh et al[6]	No	No	No	Yes	High
Omura et al[7]	No	No	No	Yes	High
Lasaridis et al[8]	No	No	No	No	High
Dissanyaka et al[9]	No	No	No	No	High
Gratz et al[10]	No	No	No	No	High
Myssiorek et al[11]	No	No	No	No	High

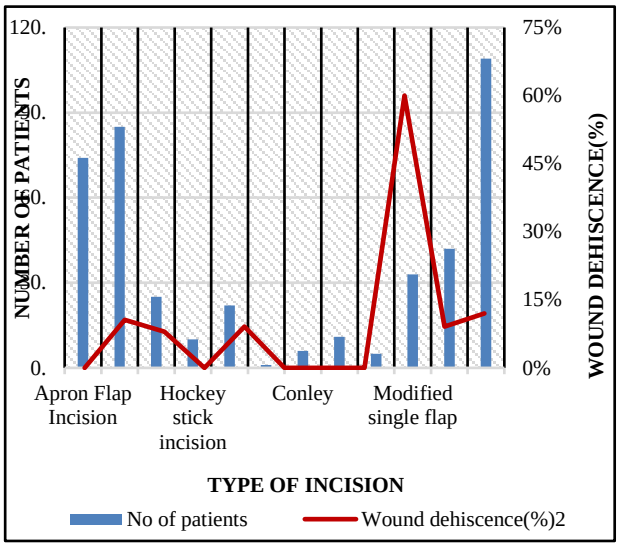

Figure 2: Variables of interest-wound dehiscence.

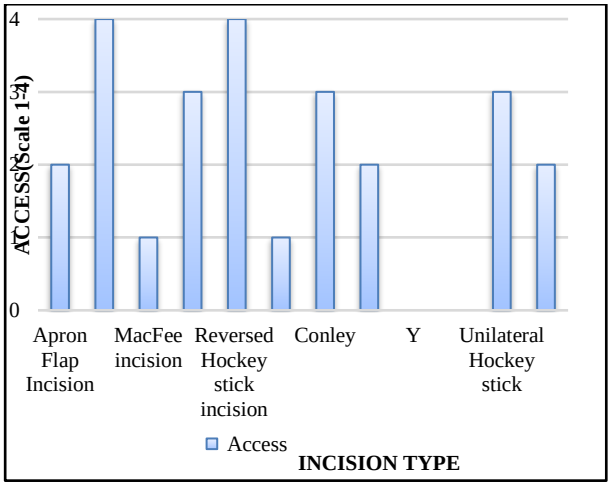

Figure 3: Variables of interest-access to lymph nodes.

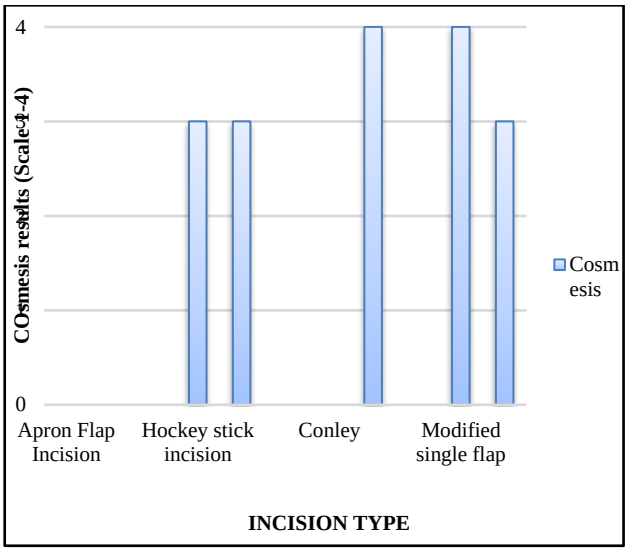

Figure 4: Variables of interest-cosmesis.

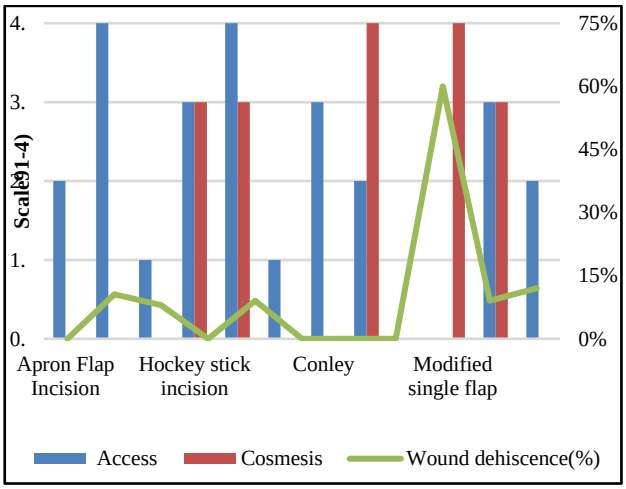

Figure 5: Variables of interest-summary.

Risk of publication bias

The assessments of the four main methodological quality items are shown in Table 6. The study was assessed to have a "high risk of bias" if it did not record a yes in three or more of the main categories; moderate if two out of 4 categories did not record a yes and LOW if randomization assessor blinding and completeness of follow-up were considered adequate.

DISCUSSION

Management of squamous cell carcinoma of the oral cavity presents a significant challenge to clinicians. Early diagnosis is the most effective weapon against Squamous cell carcinoma of the oral cavity. Treatment requires a multidisciplinary approach and is complicated by the need to rehabilitate function in the terms of speech, mastication and deglutition while providing the best aesthetics. While the many modalities of treatment available are surgery, radiotherapy, chemotherapy or a combined approach, surgery remains the main stay of treatment, more so when there is nodal involvement. Successful treatment of squamous cell carcinoma depends on complete excision of the lesion, detection and treatment of nodal involvement, Rehabilitation of oral form and function and patient counselling. The need for neck dissection in oral squamous cell carcinoma is to control the neck lymph node metastasis from the primary tumour. Carcinomas metastasize through lymph and hence the aim of the procedure is to remove the lymph nodes to which the cancerous cells might have migrated. Metastasis to the cervical lymph nodes is the most important prognostic factor in the management of oral squamous cell carcinoma. The presence of metastasis to cervical lymph nodes can reduce the cure rate by 50%.[5] Fortunately, each anatomic area of the oral cavity has a predictable lymphatic drainage pattern. Based on this knowledge lymph nodes have been grouped into defined nodal groups, allowing for better communication between clinicians and tailored surgical management of the neck.

Improved understanding of regional lymphatics and its nodal drainage has led to different modifications of the standard neck dissection, for example selective neck dissection, radical neck dissection modified neck dissection etc.[5] In humans lymph nodes do not regenerate nor can they be found in areas that have been surgically extirpated.[11] For this reason, recurrence of lymph node disease should not occur if a neck dissection has removed all nodes.

The cutaneous blood supply of the neck has been divided into four regions based on external carotid and thyrocervical arterial blood flow. The upper neck anterior to the mandibular angle is supplied by the facial artery and its branches. The occipital and posterior auricular arteries supply the skin between the jaw and the sternocleidomastoid muscle. The superior thyroid artery supplies the mid portion of the anterior neck. These three regions exhibit much overlapping. The inferior half of the neck is supplied by the transverse or superficial cervical artery branches. The blood supply of the skin overlying these regions is superficial to the platysma in a dermal-subdermal plexus. If a regional arterial supply is ligated there is retrograde supply from a neighbouring region. This explains why there is rarely skin necrosis in the region of the facial artery despite its loss in neck dissection.[11] Ideal neck incision for radical neck dissection (ND) requires sufficient exposure of the operation field, viability of the elevated skin flap, protection of the carotid artery, and acceptable postoperative cosmetic results.[10,12-14] Since Crile's landmark articlevarious incisions have evolved for neck dissection.[15,16]

The characteristics of an ideal incision for neck dissection include: Adequate exposure of surgical field, adequate blood supply to the resultant flaps, acceptable relationship of the incision to the carotid artery, easy conversion into an extended incision for removal of primary lesions, convenient for creation of stomae, compatibility with reconstructive efforts and acceptable cosmesis.[13,17]

Ngi-Wieh et al is of the opinion that of the three incisions the Macfee provides the worst exposure and the "Y" incision provides excellent access and exposure.[6] The main advantages of the apron flap incision are the avoidance of a trifurcation, maintenance of blood supply from the external carotid artery allowing for faster healing. The author suggests the use of the apron flap in previously irradiated necks in view of its reliability.

Omura et al suggests not using the hockey stick incision in cases where it is necessary to remove skin or platysma adherent to the submandibular lymph node as resection of skin in this region will affect blood supply to the apex of the incision.[7] The reversed hockey stick incision is best used in these conditions.

Lasaridis et al reports that as the vertical limb of the modified Conley incision is behind the anterior margin of the trapezius, the skin flap heals without contraction and webbing and the scar is readily hidden by hair or clothing.[8] The flap can be modified to suit the operator's needs in order to gain access to either the sternal head or the mandible for composite resections of the tongue or mandible. Dissanayaka suggests the incision can be conveniently extended upwards and forwards to split the lip if needed.[9] The use of this incision is suggested on the basis of the avoidance of a three point suture junction, the extension of the vertical limb well posterior to the carotid vessels. Gratz et al stress that the cosmetic result obtained with the unilateral hockey stick incision is acceptable while providing maximum exposure of the underlying structures.[10] Myssiorek supports the use of extended single transverse incision since there is minimal disruption of the arterial zones, adequate venous outflow and broad bases to the superior and inferior flaps.[11] The

incision tends to parallel relaxed skin tension lines in the neck minimizing scarring.

It is worth mentioning that there is a great level of heterogeneity in the included studies and hence it is difficult to come to a concrete conclusion as to which incision is superior to the other. There is a need for randomized controlled studies in which the outcomes are well defined and standardized and where conclusions as to superiority are made based on statistics rather than the author's experience.

CONCLUSION

This systematic review aims to evaluate the clinical efficacy, the postoperative complications and the aesthetic outcome of the various incisions used in neck dissection for squamous cell carcinoma. Evaluation of 175 articles from PubMed, Mesh database and hand search does not help us in drawing a conclusion about the superiority of one incision over the other. A big role in the choice of the incision is largely based on the surgeon's technical skill and surgical philosophy. The results suggest that the Apron Flap incision and the modification of Conley incision have the best healing although these incisions are average in terms of access. Reversed hockey stick incision provides the best access but there is evidence of wound dehiscence at the apex of the flap. No concrete conclusion can be formulated based on the above results due to heterogeneity of the studies. There is a need for good quality RCT's to statistically establish the superiority of one incision over the other.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Pasham PG, Ananthappan M, Jesudasan JS, Mahipathy SRRV. Comparison of the incisions used in neck dissection for oral squamous cell carcinoma-a systematic review. Int Surg J 2023;10:904-11.