

Scar cosmesis in major head and neck operations: a systematic review of skin closure techniques

Andrew Williamson¹, Andrew Connelly², and Zaid Awad¹

¹Imperial College Healthcare NHS Trust

²Queen Elizabeth University Hospital

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Abstract

Background: The cosmetic appearance of head and neck surgical scars can have a major impact on body image and quality of life. Numerous wound closure methods such as staples, sutures, adhesives and surgical tape are available, and our aim is to investigate whether one closure method offers superior cosmetic outcomes over the others. **Objectives:** The primary outcome was patient and clinician reported cosmetic appearance. Secondary outcome measures such as post-operative complications were also measured. **Design:** A systematic review was undertaken of Pubmed, Web of Science and the Cochrane database. Searches were performed using the MeSH terms “tissue adhesives”, “wound closure techniques”, “surgical tape” and “sutures”, combined with various head and neck operations using Boolean operators. **Results:** The initial search found 2753 papers, of which 2,721 were excluded after removal of duplicates and screening. 32 papers underwent full text review and 7 were included in the review. The studies did not show any significant difference in cosmesis or wound complications. Surgical staples and tissue adhesives had significantly shorter wound closure time than sutures. No studies reported on head and neck scar’s impact on quality of life or body image. **Conclusions:** From the studies presented here, there is no significant difference in short term wound cosmesis using tissue adhesives, sutures, or surgical staples. However, the papers included are generally of poor quality and contained a moderate to high risk of bias, and thus further studies are needed to establish the cosmetic and quality of life impact of varying wound closure techniques following head and neck surgery.

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MeSH Keywords: wound closure techniques, surgical stapling, suture techniques, Otorhinolaryngologic Surgical Procedures

Introduction

Surgical scars in head and neck operations are frequently extensive in order to facilitate successful excision of tumour margins and bulky nodal disease. Post-operatively, the impact of these scars on patient’s mental wellbeing can be overlooked, as these scars are more difficult to conceal compared to those left by operations on the thorax, abdomen, and limbs. Previous studies have demonstrated that scars can have a detrimental impact on a patient’s body image and quality of life (QOL) regardless of scar location. Moreover, wound complications such as infections and keloids may be much more visible in the neck, further exacerbating body confidence issues. It has been established that in subgroups including young female, Asian, and Afro-Caribbean patients, that this can potentially lead to body dysmorphia.

When closing the skin, there is a wealth of options available, including sutures, surgical staples, tissue adhesives (most commonly 2-octyl cyanoacrylate), and surgical tape (steri-strips). The efficacy of each method appears consistent within varying specialties, with systematic reviews of General surgical, Orthopaedic, Obstetric, Gynaecological, and Vascular procedures noting little difference in cosmetic outcomes. Their use is therefore dictated by surgeon preference and surgical operating time. Within the head and neck, transcervical scars used in thyroidectomy and parathyroidectomy have exhibited better short-term cosmetic outcomes when using subcuticular sutures compared to staples. Despite this work, no previous systematic reviews have assessed the effect of tissue adhesives, sutures, and staples on the appearance of scars following other major head and neck operations such as neck dissection and salivary gland resection. Resultantly, the aim of this systematic review is to answer the following questions regarding these wound closure techniques in head and neck surgery;

1. Does one technique provide better physician and patient reported cosmetic outcomes?
2. Does one technique result in reduced adverse events, post-operative pain or improved cost efficiency?
3. Does any technique have a beneficial effect on patient QOL or body image?

Methods

Search strategy

A literature search was performed in Pubmed, Web of Science, and the Cochrane library from inception to April 2021. Searches were conducted using a combination of the following MeSH terms; “head and neck surgery”, “neck dissection”, “salivary gland neoplasms”, “tissue adhesives”, “surgical tape”, “sutures”, and “wound closure techniques”. Further papers were identified using the “related articles” and “cited in” features on Pubmed. Targeted searches were performed on google, google scholar, and research gate to identify other relevant research papers and systematic reviews. The references reviews were scanned for further studies. Studies were limited to full text articles in the English language, in human patients over the age of 18 years old.

Inclusion and exclusion criteria

Inclusion criteria included any randomised or non-randomised trials comparing the cosmetic outcomes of sutures, staples, surgical tape, or tissue glue in Otolaryngology head and neck procedures. Included studies were performed in adult patients undergoing any elective head and neck operation including neck dissection, wide local excision, open lymph node biopsy, laryngectomy, pharyngectomy, parotidectomy, and submandibular gland excision. No limitations were set on year of publication, patient ethnicity, or surgical techniques.

Studies that investigated cosmetic outcomes thyroid and parathyroid, oral and maxillofacial, facial plastic, and emergency surgery were not included. Additionally, conference abstracts, letters to editor, responses, and unpublished data were also excluded. Studies were also removed if they lacked sufficient data on the operation, patient demographics or post-operative cosmetic outcomes.

Study selection

Following literature search, papers were selected according to the PRISMA statement. All titles and abstracts were scanned for relevance by two authors (AW/AC), and duplicate articles were removed. Papers that were selected for further assessment underwent full text review to assess for eligibility according to the inclusion and exclusion criteria.

Data extraction

Data was collected using the Cochrane handbook for systematic reviews of interventions v6.0 as guidance. A database was used to enter data from all eligible papers. Key data points included study design, inclusion and exclusion criteria, patient age and gender, operation, closure techniques, incision length, dressings, operating surgeon, post-operative management, time of removal, follow-up, scar cosmesis assessment used, timing of assessment, scar assessor, cosmetic outcome, and other secondary outcome measures.

Outcome measures

The primary outcome measure is the short- and long-term cosmetic results following major head and neck surgery. In addition, secondary outcomes investigated include adverse events, closure time, cost analysis, pain on removal, and effects on patient QOL and body image.

Risk of bias assessment

Each study had a quality assessment performed by two authors (AW/AC) using the Cochrane Collaboration's risk of bias tool (Rob 2). Studies were assessed for randomisation, deviations from intended intervention, missing outcome data, measurement of the outcome, selection of the reported result, and overall bias. Individual risks were assigned a score of "low", "some concerns" or "high".

Results

Search Results

The literature search found 2,746 results across all databases. After review of additional resources, a further 7 papers were added. Five hundred and thirty-four duplicated were removed, and a further 2,180 were excluded after screening of title and abstract. Full text review was performed on 32 papers and 25 were removed. Seven papers were met the inclusion criteria. One paper was thought to be suitable for inclusion; however, despite an extensive search no English language copies could be found, and it was ultimately excluded. **Figure 4** summarises the findings in a PRISMA flow diagram.

Study characteristics

Only 3 of 7 studies were randomised trials. Of these, Batra utilised double blinding and two used single blinding. Ghosh used a "split-wound" method, wherein one half of the wound was closed with either of the study interventions. In total, 434 patients were included. Two papers did not provide further demographic data, with 261 male and 113 female patients described in the remaining studies. Five papers compared sutures vs staples, and two examined sutures vs tissue adhesives. No papers compared tissue adhesives vs staples or steri-strips to other closure methods, and none reviewed more than two methods. All papers used interrupted skin sutures with various materials (silk, nylon, and prolene) with the exception of Maw, which used subcuticular suturing. **Table 1** lists the key study characteristics and interventions.

Surgical procedures

The most common operation described was neck dissection (296), of which 53 were combined with a pectoralis major flap. Other procedures included parotidectomy (23), total laryngectomy (52), lymph node excision

(34) and submandibular gland excision (18). Two papers, comparing cyanoacrylate and sutures, performed a variety of operations including 32 thyroidectomies.

Platysma or subcutaneous suturing before skin closure was described in 4 papers. Operations were performed by a single senior surgeon in 2 studies. Four papers described use of drains and 4 used post-operative intravenous antibiotics. Study characteristics and details of surgical procedures are summarised in **table 2**.

Primary outcome measure

Four out of five papers comparing sutures and staples noted no significant difference in wound cosmesis, with one (Oswal) finding a significantly superior cosmetic outcome favouring staples at 3 months ($p=0.03$). No studies found a significant difference in cosmetic outcomes between sutures or tissue adhesives. Three papers compared cosmetic outcomes using a visual analogue scale only one using a validated assessment tool, the Hollander wound evaluation score (HWES). A “good”, “moderate” and “poor” observer assessment scale was used in 3 papers. Six studies used independent observers, of which 4 reported blinding of these assessors. Only Bozkurt used a patient orientated assessment, using a “yes/ no” question for satisfaction with appearance. Timing of follow-up assessments varied wildly, from date of removal to 180 days. A summary of cosmetic outcomes is given in **table 3**.

Secondary outcome measures

No trials included analysis of patient QOL or body image. The most commonly reported secondary outcomes were closure time (5) and cost (5). Other reported outcomes included pain on removal and wound inflammation. Adverse events were reported in 56 patients; most commonly wound dehiscence and wound infection (50 patients). Oswal noted a significant reduction in wound complications in staples compared to sutures ($p=0.044$) but noted significantly lower pain on removal scores in sutures ($p<0.05$). Six trials noted a significantly longer wound closure time between sutures vs adhesives or staples. The secondary outcome measures are demonstrated in **table 4**.

Bias assessment

Risk of bias assessment uncovered numerous concerns regarding the study’s methodology, with all papers demonstrating “some concerns” (5) to “high” (2) risk. Overall quality of trials varied considerably, with incomplete reporting of methods and results inhibiting a thorough bias assessment. No trials were registered in Clinicaltrials.gov, meaning comparison of planned and reported outcomes was not possible. Only Maw described 6 patients lost to follow-up, and no studies described an intention to treat analysis. Risk of bias assessment is summarised in **table 5** and **figure 2**.

Discussion

Summary of main results

Head and neck incisions can result in the some of the most noticeable scars of any surgical specialty, with the resulting cosmetic defects often having a detrimental effect on patient’s QOL. Various wound closure methods are employed in head and neck surgery, but there are few studies examining how these ultimately influence the appearance of scars in the neck. The primary aim of this review was therefore to determine if any method resulted in a superior cosmetic outcome. It was found that in the short term there was no significant difference in scar appearance between interrupted skin sutures, staples and tissue adhesives. Staples and tissue adhesives were found to be faster but more expensive than sutures, which may be the only variables that influence a surgeon’s choice of technique.

Sutures vs staples

By reviewing the studies comparing sutures and staples, it may be concluded that neither intervention results in any significant short term cosmetic benefit. Oswal did note staples exhibited a small advantage at 3 months ($p=0.03$). However, scar healing and remodelling may take up to 12 months, meaning both groups could have had the potential to recover over a more prolonged period of follow-up. Only dos Santos

followed-up patients beyond three months, meaning no studies could accommodate for wound maturation or late scar complications such as keloids.

Staples had a significantly faster closure time, a finding consistent with systematic reviews across various specialties. Whilst prolonged operative time is associated with an increased risk of post-operative complications, it is debatable that a delay of seconds to minutes could have a harmful influence on post-operative outcomes.

The choice of sutures and techniques across these studies is of interest, as all made use of non-absorbable interrupted skin sutures. Previous studies of facial lacerations found interrupted absorbable and non-absorbable sutures have similar cosmetic outcomes and rates of post-operative infection. However, non-absorbable sutures offer the additional benefits not requiring removal and lower rates of wound dehiscence; advantages that could be paralleled to a comparative study with staples. The use of interrupted sutures may also confer another source of bias, as systematic reviews have shown that this technique can result in inferior cosmetic outcomes compared to subcuticular sutures. Furthermore, in a systematic review of thyroid and parathyroid surgeries, the cosmetic outcomes of subcuticular sutures were superior to staples. This suggests the studies reviewed may be over-estimating the cosmetic equivalency of sutures and staples by not comparing the latter to a cosmetically superior suturing technique.

One study was weakly positive for a higher rate of wound complications when closing with nylon sutures compared to staples ($p=0.44$), but this was not documented in papers using silk sutures. This somewhat contradicts established dogma that non-synthetic braided sutures may generate a greater localised tissue reaction than synthetic monofilaments, resulting in greater incidences of wound inflammation. Notably, this paper does not describe use of post-operative intravenous antibiotics or antiseptic wound dressings. Although a previous Cochrane review could not draw any conclusions on the effectiveness of wound dressings, meta-analyses have demonstrated post-operative intravenous antibiotics can reduce the rate of surgical site infections in non-contaminated wounds. Whilst the routine use of intravenous antibiotics is not always indicated, it could be speculated that infection rates could have been masked in those that used antibiotics in their protocol.

Sutures vs tissue adhesive

Two papers compared sutures and tissue adhesives. Bozkurt et al had a high risk of bias, as it did not fully report its cosmetic outcomes, merely stating “all” patients were satisfied with appearance. Comparatively, Maw et al is hampered by a lack of randomisation but made use of blinded assessors and was the only paper to use absorbable subcuticular sutures, thus providing a potentially more reliable cosmetic comparison to adhesives. Additionally, this was the only paper to use a validated wound evaluation scale. The HWES examines five wound features (rated as yes or no) and an overall wound score from 1-10, and can be modified to include a patient rating. It has been utilised in various specialties comparing wound closure methods, ranging from paediatric surgery to maxillofacial and neurosurgery.

Neither paper found a significant difference in the appearance of scars between sutures or tissue adhesives. This is echoed in a Cochrane review which did not find a significant difference in patient or clinician reported outcomes across 5 studies. However, the authors did report a higher prevalence of wound dehiscence and a faster closure time in adhesives, with the latter finding being identified in our review.

Limitations

There are a number of limitations to this review. Steps were taken to find all relevant papers; however, there remains a potential to miss suitable articles and exclude certain research due to a lack of English translation. In addition, a secondary aim was to assess scars impact on QOL and body image. Factors such as psychological distress and poor QOL can have a negative impact on patient scar assessment scores, and more holistic scar questionnaires such as the Patient scar assessment questionnaire (PSAQ) appear to have a greater correlation with a patient’s body image. It is unfortunate that most studies only utilised visual analogue scales or simple dichotomous “patient satisfaction” questions; and none assessed the impact

of scars on the patient’s mental health.

Quality of evidence

This systematic review is hindered by the poor quality of the papers; with a lack of randomisation, poor reporting of results, and inadequate outcome measurements resulting in all studies having “some concerns” or “high” risk of bias. The heterogeneity in study design and low number of studies in each comparison arm prevented any meaningful meta-analysis from being performed. This regrettably means our conclusion that tissue adhesives, sutures, and staples have equivalent cosmetic outcomes should be read with caution.

Implications for future research

Further studies with a more robust design may help in determining a best possible closure method in head and neck operations. The optimal trial design would be prospective, randomised with a longer follow-up to accommodate for wound remodelling. Studies could compare not only sutures and staples, but the overlooked tissue adhesives and surgical tape, using subcuticular sutures as a control group. Scar appearance should be analysed by a clinician and patient using validated questionnaires such as the patient and observer scar assessment scale (POSAS) or the PSAQ. This could be corroborated with the impact on a patient’s QOL and body image using assessments such as the body image questionnaire.

Research into minimal access robotic and open thyroidectomy has suggested wound location does not impact upon a patient’s opinion of their scar. Nevertheless, it could be presumed some incisions, such as those for neck dissection, may be more disfiguring than more subtle salivary gland scars. Avoidance of this mismatch could be achieved through comparison of a single operation, studying matched cohorts, or performing subgroup analysis.

Conclusion

In conclusion, there appears to be no significant short-term difference in cosmetic outcomes between sutures, staples and tissue adhesives in head and neck incisions. However, the results of this review should be interpreted with caution owing to the poor quality of relevant trials. Further trials with more robust methodology may be required to ascertain the true cosmetic and QOL value of these wound closure techniques, in particular tissue adhesives, subcuticular sutures and steri-strips, which have been under-explored in the literature.

Key points

1. In the reported studies there are no statistically significant differences in short term patient and clinician reported cosmetic outcomes between sutures, staples and tissue adhesives.
2. Staples and tissue adhesives offer a faster closure time than sutures, whilst staples are significantly more expensive than sutures.
3. No studies reported on the impact of surgical wound closure techniques on patient body image or quality of life.
4. There is no significant difference in post-operative wound complications between sutures staples and tissue adhesives.
5. The current literature is of poor quality and has a moderate to high risk of bias. Further high-quality studies are required to assess the impact of wound closure techniques on wound cosmesis, patient quality of life, and body image.

References

List of tables

Table 1 - summarises the key study characteristic including trial design, patient demographic and trial interventions. Abbreviations: RT= randomised trial, NRT= non-randomised trial

Table 2 - summarises the key surgical features of the included study including operation type and post-operative management. Abbreviations: WLE= wide local excision, LN= lymph node, ND= neck dissection,

PM= pectoralis major flap, SMG= submandibular gland, IV= intravenous

Table 3 - summarises features and outcomes of wound cosmesis assessments across the eligible studies

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