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ORIGINAL ARTICLE

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The outcome of sutured wounds compared with tissue adhesive for paediatric wound closure: A meta-analysis

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Abstract

A meta-analysis investigation was executed to measure the outcome of sutured wounds (SWs) compared with tissue adhesive (TA) for paediatric wound closure (PWC). A comprehensive literature inspection till February 2023 was applied and 2018 interrelated investigations were reviewed. The 18 chosen investigations enclosed 1697 children with PWC in the chosen investigations' starting point, 977 of them were utilising SWs, and 906 were utilising TA. Odds ratio (OR) in addition to 95% confidence intervals (CIs) were used to compute the value of the effect of SWs compared with TA for PWC by the dichotomous approaches and a fixed or random model. SWs had significantly higher wound cosmetic (WC) scores (mean deviation [MD], 1.70; 95% CI, 0.57–2.84, $P = .003$), lower wound dehiscence (WD) (OR 0.60; 95% CI, 0.06–0.43, $P < .001$), and lower cost (MD, −10.22; 95% CI, −10.94 to −9.50, $P < .001$) compared with those with TA in PWC. No significant difference was found between children utilising SWs and TA in wound infection (WI) (OR, 0.45; 95% CI, 0.15–1.30, $P = .14$) with no heterogeneity ($I^2 = 0\%$) in PWC. SWs had significantly higher WC scores, lower WD, and lower cost, yet, no significant difference was found in WI compared with those with TA in PWC. However, care must be exercised when dealing with its values because of the low sample size of some of the nominated investigations and the low number of selected investigations for the meta-analysis.

KEYWORDS

paediatric wound closure, sutured wounds, tissue adhesive, wound cosmetic

Key Messages

- a meta-analysis investigation was executed to measure the outcome of sutured wounds compared with tissue adhesive for paediatric wound closure

Xiaomei Cui, Yuanbo Zhang, and Na Wang contributed equally to this article and should be considered as co-authors.

- sutured wounds had significantly higher wound cosmetic scores, lower wound dehiscence, and lower cost, yet, no significant difference was found in wound infection compared with those with tissue adhesive in paediatric wound closure
- however, care must be exercised when dealing with its values because of the low sample size of some of the nominated investigations and the low number of selected investigations for the meta-analysis

1 | INTRODUCTION

Although tissue adhesive (TA) can also be used to close wounds, sutures have traditionally been the preferred method. There is not much evidence, although, to show which of these methods is more effective.[1] The term 'TA' describes a class of chemicals known as cyanoacrylates. When the liquid TA comes in touch with blood or moisture on the skin, it polymerises into a waterproof film that bonds the opposing edges together.[2] For ages, adhesive tape has been used to accomplish wound edge apposition.[1] Because of the low tensile strength the tape transmits, although, the usage of adhesive tape without adjunctive tension-relieving sutures is often restricted to reasonably stationary, low-tension wounds.[3] TA could similarly be used either as an adjunct to sutures for supplementary wound strength or as a dressing.[4] Both have been used to treat surgical wounds and abrasions in kids, but it's still unclear which method works better.[5] The purpose of this meta-analysis was to identify the strategy that provides the best outcomes for the healing of surgical wounds and lacerations in children. Clinician evaluation of wound cosmesis served as our main result. Other problems, cost, and the occurrence of wound infection (WI) and wound dehiscence (WD) were considered secondary outcomes. Hence, this meta-analysis's aim was to compare the sutured wounds (SWs) with TA for paediatric wound closure (PWC) on wound cosmetics (WCs).

2 | METHODS

2.1 | Eligibility criteria

For the purpose of creating a summary, the investigations demonstrating the connection between SWs and TA with PWC were chosen.[6]

2.2 | Information sources

Figure 1 represents the whole investigation. The literature was incorporated into the investigation when the inclusion criteria were met:

1. The research was an observational, prospective, retrospective, or randomised controlled trial (RCT) investigation.
2. Subjects with PWC were the investigated chosen individuals.
3. The intervention incorporated SWs and TA.
4. The investigation distinguished the effect of SWs compared with TA for PWC.
5. The research was excluded if they included persons where the significance of the comparison was not emphasised in it, investigations that did not check the characteristics of the effect of SWs compared with TA for PWC, and research on WCs children without SWs.

2.3 | Search strategy

A search protocol operations were recognised depending on the PICOS opinion, and we characterised it as next: topics for subjects with PWC, P; SWs, and TA are the 'intervention' or 'exposure', while the 'comparison' was between SWs and TA; WCs, wound, WD, cost, and infection were the 'outcome' and last, of all, the proposed investigation had no restrictions.[7]

We have searched Google Scholar, Embase, the Cochrane Library, PubMed, and OVID databases exhaustively till February 2023 utilising an organisation of keywords and accompanying terms for tissue adhesive; paediatric wound closure; wound cosmetic; and sutured wounds as shown in Table 1. To avoid research that failed to establish a link between the consequences of the effect of SWs compared with TA for PWC, replications were removed from the papers, they were combined into an EndNote file, and the titles and abstracts were reevaluated.

2.4 | Selection process

Following the epidemiological declaration, a process was formed, which was then organised and analysed in the procedure of a meta-analysis.

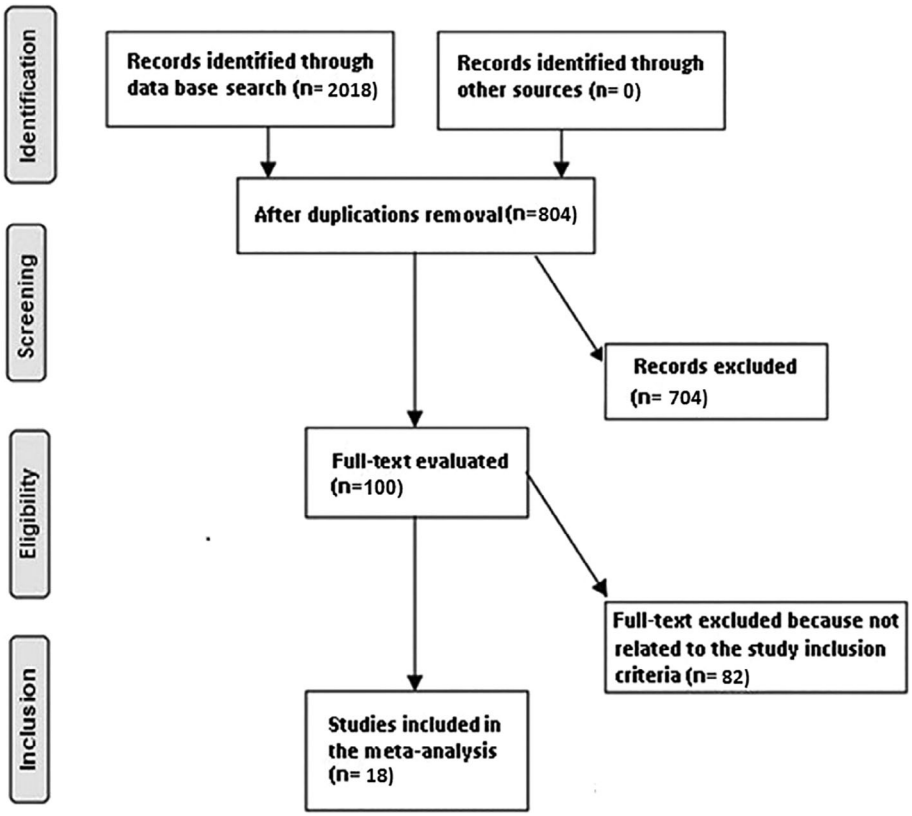

FIGURE 1 A flowchart of the investigation process.

TABLE 1 Search strategy for each database.

Database	Search strategy
Pubmed	#1 "sutured wounds"[MeSH Terms] OR "paediatric wound closure"[All Fields] [All Fields] #2 "wound cosmetic"[MeSH Terms] OR "Tissue adhesive"[MeSH Terms] [All Fields] #3 #1 AND #2
Embase	'sutured wounds'/exp OR 'paediatric wound closure' #2 'wound cosmetic'/exp OR 'Tissue adhesive' #3 #1 AND #2
Cochrane library	(sutured wounds):ti,ab,kw (paediatric wound closure):ti,ab,kw (Word variations have been searched) #2 (wound cosmetic):ti,ab,kw OR (Tissue adhesive): ti,ab,kw (Word variations have been searched) #3 #1 AND #2

2.5 | Data collection process

Amongst the criteria used to collect data were the name of the primary author, the investigation date, the year of the investigation, the country or area, the population type, the medical and therapy physiognomies, categories, the quantitative and qualitative estimate process, the data source, the consequence estimate, and statistical analysis.[8]

2.6 | Data items

Whenever an investigation had variable values, we separately acquired the data based on an evaluation of the effect of SWs compared with TA for PWC.

2.7 | Investigation risk of bias assessment

Two authors independently estimated the procedure of the selected publications to see whether there was a possibility that each investigation may have been biased. The procedural quality was estimated utilising the 'risk of bias instrument' from the Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0. After being categorised by the appraisal criteria, each investigation was allocated one of the bias risks indicated below: low: An investigation was categorised as having a low bias risk if all of the quality criteria were met; an investigation was categorised as having a medium bias risk if one or more requirements were not met or were not

encompassed. The investigation was deemed to have a significant bias risk if one or more quality needs were either completely or just partially met.

2.8 | Effect measures

Sensitivity analyses were only carried out on research that assessed and documented the effect of SWs compared with TA for PWC. To compare SWs and TA in PWC individuals' sensitivity, a subclass analysis was used.

2.9 | Synthesis methods

A random- or fixed-effect model was used to generate the odds ratio (OR) and a 95% confidence interval (CI) utilising dichotomous or continuous approaches. Between 0% and 100%, the I^2 index was determined. The values at 0%, 25%, 50%, and 75%, respectively, presented no, low, moderate, and high heterogeneity.[9] Other features that show a strong degree of alikeness amongst the related research were also analysed to make sure the correct model was being used. The random effect was considered if I^2 was 50% or above; if I^2 was <50%, the possibility of utilising fixed-effect rose.[9] A subclass analysis was carried out by stratifying the initial estimation by the aforementioned consequence groups. A *P*-value of <.05 was used in the analysis to specify the statistical significance of differences between subcategories.

2.10 | Reporting bias assessment

Investigations bias was measured statistically and qualitatively utilising the Egger regression test and funnel plots that exhibit the logarithm of the ORs versus their standard errors (investigations bias was deemed present if $P \geq .05$).[10]

2.11 | Certainty assessment

Two-tailed testing was used to investigate each P-value. The graphs and statistical evaluations were generated utilising Reviewer Manager Version 5.3 (The Nordic Cochrane Centre, the Cochrane Collaboration, Copenhagen, Denmark).

3 | RESULTS

18 publications, published between 1993 and 2022, from a total of 2018 connected investigations that met the inclusion criteria were chosen and involved in the investigation.[11-28] The results of these researches are presented in Table 2. 1697 children with PWC were in the chosen investigations' starting point, 977 of them were utilising SWs, and 906 were utilising TA. The sample size was between 22 and 188 children.

SWs had significantly higher WC scores (MD, 1.70; 95% CI, 0.57–2.84, $P = .003$) with high heterogeneity ($I^2 = 93\%$), lower WD (OR 0.60; 95% CI, 0.06–0.43, $P < .001$) with no heterogeneity ($I^2 = 0\%$), and lower cost (MD, −10.22; 95% CI, −10.94 to −9.50, $P < .001$) with low heterogeneity ($I^2 = 49\%$) compared with those with TA in PWC as shown in Figures 2–4.

No significant difference was found between children utilising SWs and TA in WI (OR, 0.45; 95% CI, 0.15–1.30, $P = .14$) with no heterogeneity ($I^2 = 0\%$) in PWC as shown in Figure 5.

The lack of data prevented stratified models from being used to inspect the effects of particular factors, for example, ethnicity, and gender, on comparison outcomes. No evidence of investigation bias was found ($P = .88$) utilising the quantitative Egger regression test and the visual interpretation of the funnel plot. The majority of the implicated RCTs, although, were found to have poor procedural quality and no bias in selective reporting.

4 | DISCUSSION

In investigations that were considered for the meta-analysis, 1697 children with PWC were in the chosen investigations' starting point, 977 of them were utilising SWs, and 906 were utilising TA.[11-28] SWs had significantly higher WC scores, lower WD, and lower cost compared with those with TA in PWC. No significant difference was found between children utilising SWs and TA in WI in PWC. However, care must be exercised when dealing with its values caused by the low sample size of some of the nominated investigations (11 out of 18 ≤ 100 children) in addition to that all the selected investigations were ≤200 children as sample size and a low number of nominated investigations for the meta-analysis. That would affect the level of significance of the evaluations studied.

In the paediatric population, non-suture procedures are frequently used for skin closure because of their theoretical advantages, which include even tension distribution over the wound, painless closure, and a lack of suture removal.[29] Evidence contrasting them directly with traditional suture closure is contradictory, although. The cosmetic outcomes of wounds repaired with TA and sutures, as reported by the clinicians, were comparable. Similar findings were found in a meta-analysis of adult

TABLE 2 Characteristics of the selected investigations for the meta-analysis.

Study	Country	Total	Sutured wounds	Tissue adhesive
Quinn[11]	Canada	75	38	37
Quinn[12]	Canada	132	67	65
Barnett[13]	New Zealand	163	80	83
Bruns[14]	USA	83	41	42
Singer[15]	USA	124	61	63
Bernard[16]	USA	52	28	24
Ong[17]	Singapore	59	33	26
Van den Ende[18]	Netherlands	100	50	50
Zempsky[19]	USA	93	45	48
Spauwen[20]	Netherlands	30	15	15
Knott[21]	USA	22	11	11
Wilson[22]	UK	121	186	121
Brown[23]	USA	134	70	64
Collin[24]	UK	36	14	22
Saxena[25]	India	70	35	35
Tandon[26]	Australia	188	93	95
Ladipo-Ajayi[27]	Nigeria	75	40	35
Rout[28]	India	140	70	70
	Total	1697	977	906

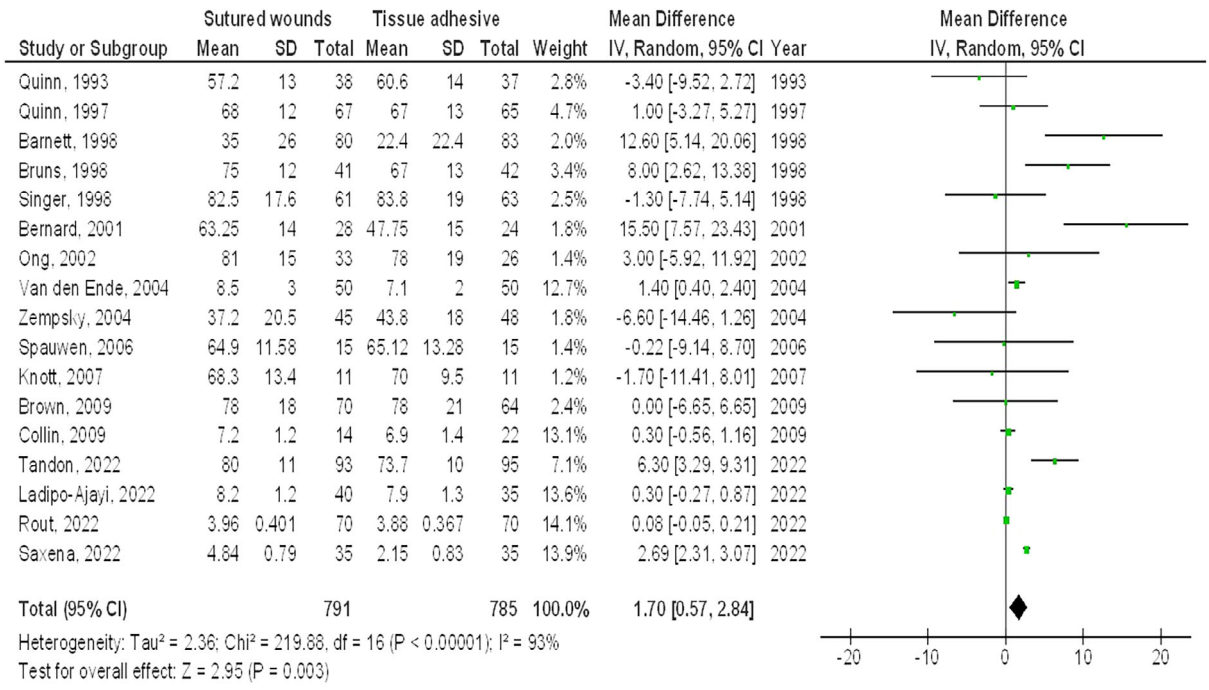

FIGURE 2 The effect's forest plot of the SWs compared with TA on WCs in PWC.

subjects.[30] It is crucial to take into account the pronounced disparity amongst investigations in relation to technique and timing of cosmesis valuation when interpreting our results for cosmetic outcomes. Although the Visual Analogue Scale and Hollander Wound Evaluation Scale were most frequently used, other investigations made use of different measures. The period of time for cosmetic evaluation also varied, from 2 to 3 weeks to

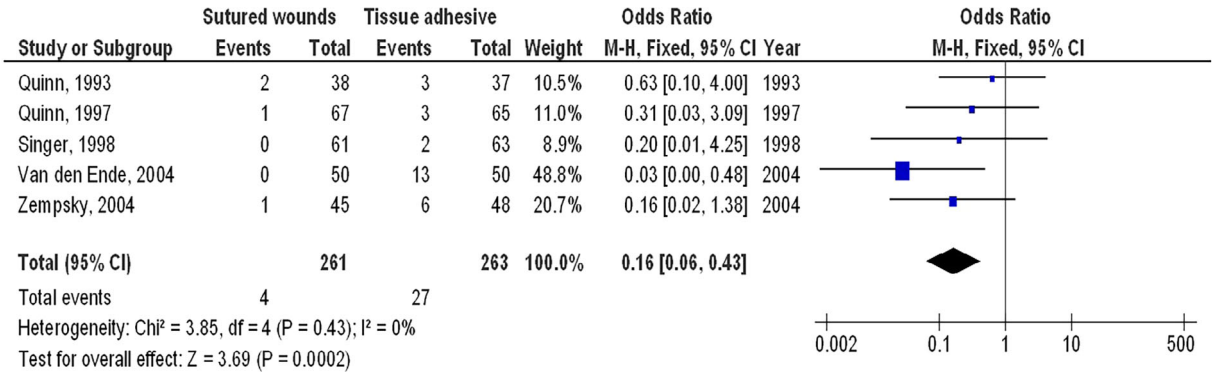

FIGURE 3 The effect's forest plot of the SWs compared with TA on WD in PWC.

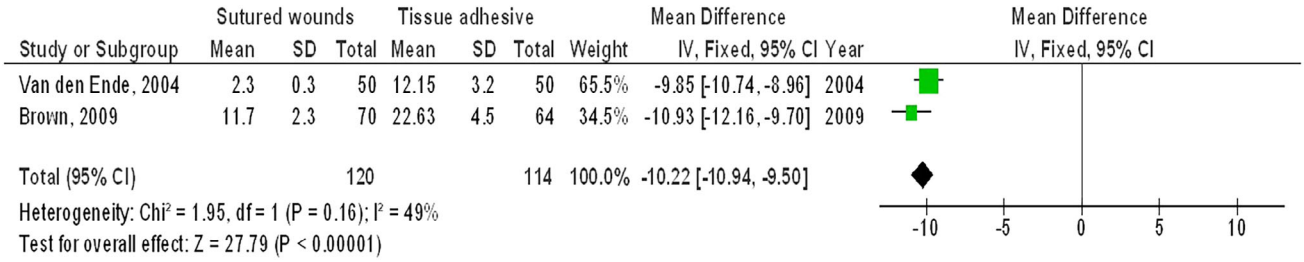

FIGURE 4 The effect's forest plot of the SWs compared with TA on cost in PWC.

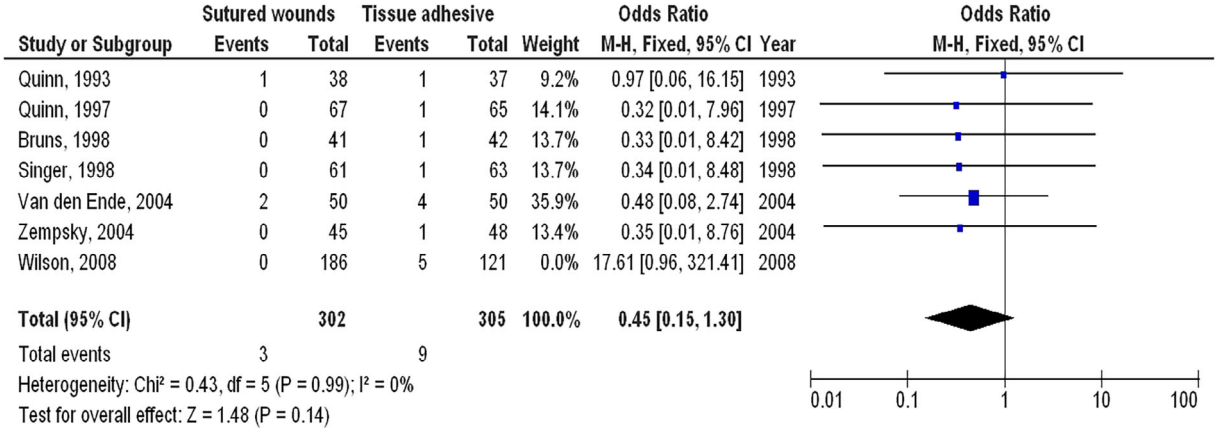

FIGURE 5 The effect's forest plot of the SWs compared with TA on WI in PWC.

more than 2 years after the treatment. Just short-term follow-up data were provided for a few investigations. A 2014 Cochrane review found no difference in infection rates when comparing TA with sutures. Similar results have been seen in adult subjects.[31] The analysis, however, lacked sufficient strength to identify a meaningful difference.[31] When Gkegkes et al. compared adhesive tape and sutures for the closure of surgical wounds in adults; they discovered no differences in infection rates.[32] It is crucial to keep this in mind when interpreting our results because the majority of investigations focused on clean, straightforward wounds with low infection risk. Children's infection risk has been estimated to range from 1.2% to 6.6%, with infected or filthy wounds carrying a higher risk.[33] Both toddlers and adults who have had lacerations are at risk for infection after closure.[34] The low overall infection incidence may have been a result of the low number of difficult, contaminated wounds, which may have concealed any differences in skin closure methods. TA wound closure has been shown to considerably decrease the risk of infection compared with SW closure in animal models.[35] In particular, TAs have been shown to prevent the growth of Gram-positive bacteria.[36] Once polymerised, these adhesives seal the

wound and create a barrier against outside contamination.[37] In terms of microbiological contamination, utilising microporous adhesive tape like Steri-Strips seems to have mixed results. During 24 h after applying microporous tape to the skin, the number of bacteria on the skin was identical to that on exposed skin, but at 48 hours, the number of bacteria on tape-covered skin was much higher.[38] Surgical tapes, according to Kolt's paper, do, however, prevent bacterial development, which clinically translates into a lower rate of WI.[39] Similar rates of WD (0.5%–1.0%) were seen in all three groups. A meta-analysis of adult subjects showed that SWs were 3.35 times more likely to dehisce than surgical wounds that were closed with TA.[31] Although the analysis was underpowered, there was no discernible difference in the risk of dehiscence between wounds treated with TA and adhesive tape. When evaluating the risk of dehiscence between taped wounds and SWs in adult surgical subjects, Gkegkes et al., found no difference.[32] After intra-abdominal surgery, WD is a rare problem in children, occurring in less than 1% of subjects.[40] The low rate of dehiscence is not surprising given that the bulk of the included investigations in our systematic analysis analysed tiny low-tension wounds. Typically, only low-tension, tiny lacerations have been treated with tissue glue[41]; this may be because of worries about the original cyanoacrylates' limited tensile strength and consequently rigid wound closure. Some modern adhesives, including octylcyanoacrylate, are more flexible and transmit greater tensile strength.[41] Octyl-cyanoacrylate has been used successfully to treat lengthy (4 cm) surgical wounds in adults[42] as well as high-tension wounds in kids when combined with adjuvant adhesive tape and splints for immobilisation.[43] Because of their low tensile strength and potential for losing their bond with the skin, which increases the danger of dehiscence,[44] adhesive tapes have also only been used to close low-tension wounds.[45] However, to strengthen the sellotape and guarantee longer-lasting adherence, supplementary chemical adhesives like Mastisol might be used.[2] Investigations on animals comparing the wound bursting power of wounds sealed with TA and wounds sealed with adhesive tape have shown that wounds sealed with TA require much more pressure to be compromised than wounds sealed with adhesive tape.[46]

This meta-analysis confirmed the effect of SWs compared with TA for PWC. More inspection is still desirable to clarify these feasible influences. This was also emphasised in former investigations that used a related meta-analysis procedure and originate equivalent values of the influence.[47,48] Although the meta-analysis was incapable to discover if differences in these characteristics are related to the outcomes being researched, properly-led RCTs are vital to consider these aspects as well as the mixture of different gender, and ethnicities of individuals. In conclusion, SWs had significantly higher WC scores, lower WD, and lower cost compared with those with TA in PWC. No significant difference was found between children utilising SWs and TA in WI in PWC.

4.1 | Limitations

Because some of the investigations involved in the meta-analysis were not included, there might have been selection bias. The omitted publications, however, did not fulfil the necessities for inclusion in the meta-analysis. Also, we lacked the expertise to determine whether factors like gender and ethnicity influenced results. The purpose of the investigation was to measure the effect of SWs compared with TA for PWC. Bias may have grown because incomplete or incorrect data from earlier research were included. Possible sources of bias involved the individuals' nutritional status in addition to their races, and genders. Unwantedly, incomplete data and certain unpublished work may distort the value that is being examined.

5 | CONCLUSIONS

SWs had significantly higher WC scores, lower WD, and lower costs compared with those with TA in PWC. No significant difference was found between children utilising SWs and TA in WI in PWC. However, care must be exercised when dealing with its values caused by the low sample size of some of the selected investigations (11 out of $18 \leq 100$ children) and the low number of selected investigations for the meta-analysis.

DATA AVAILABILITY STATEMENT

On request, the corresponding author is required to provide access to the meta-analysis database.

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