

RESEARCH

Open Access



# Effectiveness of Reso-Pac in enhancing wound healing after third molar surgery: a systematic review with meta-analysis of randomized controlled trials

Savitha Lakshmi Raghavan<sup>1</sup>, Gowardhan Sivakumar<sup>2</sup> and Sasidharan Sivakumar<sup>3\*</sup>

## Abstract

**Background** Surgical site infections (SSIs) and postoperative complications such as pain, haemorrhage, and nerve damage are significant concerns in oral surgery due to the high bacterial load in the oral cavity. Traditional intraoral dressings, though commonly used, have limitations in effectively preventing infections and promoting wound healing, especially following the surgical extraction of impacted mandibular third molars. Reso-Pac, a self-dissolving hydrophilic wound protection paste, has emerged as a potential solution, offering benefits such as medication delivery, protective barrier functions, and astringent properties.

**Objective** To evaluate the efficacy of Reso-Pac, a self-dissolving hydrophilic wound protection paste, in reducing postoperative pain and promoting wound healing following the surgical extraction of impacted mandibular third molars.

**Methods** A systematic review and meta-analysis were conducted according to PRISMA guidelines. Four randomized controlled trials (RCTs) that met the predefined PICOS criteria were included. Three of these studies were used in the quantitative synthesis. Data extraction and risk of bias assessment were performed independently by multiple reviewers.

**Results** The meta-analysis demonstrated a significant reduction in pain on the 7th postoperative day with Reso-Pac compared to gauze pack controls, with a pooled effect estimate of -2.79 (95% CI: -4.18 to -1.40). Additionally, Reso-Pac significantly enhanced wound healing, with a pooled estimate of 2.71 (95% CI: 1.52 to 3.89). Bayesian meta-analysis supported these findings, though moderate evidence was indicated due to heterogeneity.

**Conclusions** Reso-Pac significantly reduces postoperative pain and promotes efficient wound healing in patients undergoing surgical removal of impacted mandibular third molars. Despite few limitations, like in the number of studies and methodological variations, Reso-Pac shows substantial clinical potential as an effective treatment for improving postoperative recovery in oral surgeries. Further research is recommended to validate these findings across diverse populations.

\*Correspondence:  
Sasidharan Sivakumar  
sasidharan.icmr@gmail.com

Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

**Protocol registration number** CRD42024541873.

**Keywords** Oral surgery, Wound healing, Postoperative pain, Third molar, Meta-analysis, Systematic review

## Introduction

In oral surgery, the high concentration of bacteria in the oral cavity increases the risk of surgical site infections (SSIs) [1, 2], which remain a concern despite advancements in management techniques, along with complications like haemorrhage and nerve damage [1, 2]. Intraoral incisions, commonly performed during procedures such as impacted tooth removal, can introduce endogenous bacteria into the surgical site, thereby increasing the risk of postoperative infections [1, 2]. This risk is higher in mandibular surgeries due to reduced blood circulation and the accumulation of saliva and debris [1, 2]. The prevalence of SSIs varies widely, underscoring the importance of effective wound management. Several factors influence post-surgical healing including bacterial contamination, wound cleanliness, the patient's intrinsic healing capacity, the surgical technique used and patient-specific variables such as medical history and lifestyle habits. [3]. Contamination remains a significant challenge, especially with food intake, often requiring dietary changes that may affect the patient's nutrition [4]. Traditionally, intraoral dressings have been used to mitigate risks and promote healing. Various wound management methods exist, including saline and povidone-iodine irrigation [5], antibiotic gels [6–8], medicated packs [6–8], and membranes [6–8], each with their own limitations. Topical gels and solutions provide only temporary cleansing and require frequent reapplication [5, 7, 9, 10]. Membranes offer wound protection but necessitate suturing for secure fixation and may present economic challenges [5, 7, 9, 10]. This situation often leads to dietary modifications that can impact the patient's nutritional status [5, 7, 9, 10].

Reso-Pac from Hager Worldwide, USA is a self-dissolving hydrophilic wound protection paste made from Carboxymethyl cellulose, polyvinyl acetate, ethyl alcohol, myrrh, vaseline, polyethylene oxide resin, offers a promising solution in oral surgery. It is known for its antiseptic, astringent and haemostatic properties. It is applied to the wound after being kneaded and shaped. Upon setting, it forms a gelatinous, elastic bandage that accelerates healing and reduces complications by serving as a medication carrier, protective barrier, astringent and disinfectant, similar to an intraoral bandage [3]. Reso-Pac's versatility extends to periodontal and endodontic procedures [3]. However, there remains considerable variability in the reported effectiveness of various intraoral wound management agents, including newer dressings like Reso-Pac, with limited consensus on their comparative benefits. Despite individual studies suggesting positive outcomes

with Reso-Pac, there is a lack of consolidated evidence evaluating its efficacy in oral surgery. This inconsistency in the literature underscores the need for a systematic review and meta-analysis to critically appraise and quantitatively synthesize the available randomized controlled trials to guide clinical decision-making. This systematic review and meta-analysis of randomized controlled trials aims to assess Reso-Pac's effectiveness in reducing pain and enhancing wound healing of the surgically removed impacted mandibular third molars.

## Materials and methods

### Review question

This review was conducted in strict accordance with the "Preferred Reporting Items for Systematic Reviews and Meta-Analysis" (PRISMA) guidelines, aiming to address the following research question: "Does the application of Reso-Pac dressing enhance postoperative wound healing and alleviate pain in patients undergoing surgical extraction of impacted mandibular third molars?"

### Inclusion and exclusion criteria

The eligibility criteria for this review were determined based on the PICOS framework as follows:

- **(P) Population:** Patients undergoing surgical extraction of impacted mandibular third molars.
- **(I) Intervention:** Application of Reso-Pac.
- **(C) Comparison / Control:** Alternative therapeutic agents or placebo.
- **(O) Outcomes:** Reduction in postoperative pain and improvement in wound healing.
- **(S) Study design:** Experimental trials.

Only original studies that adhered to the "Population, Intervention, Control, Outcome" (PICO) framework were considered for inclusion. Studies involving ex vivo cell models, case reports, or case series were excluded to ensure focus on clinically relevant data.

### Search strategy for article identification

The two researchers (S.R. and G.S.) independently conducted electronic search for relevant randomized controlled trials (RCTs) across multiple databases, including Medline (via PubMed), Web of Science, Scopus, EMBASE, and Google Scholar, until April 30, 2024. The search strategy for each database was tailored using appropriate Boolean operators, ensuring comprehensive coverage without imposing additional restrictions (Table 1).

**Table 1** Search strategy for the databases

Database	Nos.	Search strategy
MEDLINE (PubMed)	15	(((third molar[MeSH Terms]) OR (third molars[MeSH Terms]) OR (wisdom teeth[MeSH Terms]) OR (wisdom tooth[MeSH Terms])) AND (((cellulose[MeSH Terms]) OR (cellulose)) OR (Reso-Pac)) OR (myrrh))
Scopus	9	((ALL ("third molar") OR ALL ("wisdom teeth")) AND ((ALL (Reso-Pac) OR ALL (cellulose) OR ALL (myrrh)))
Web of Science	12	((ALL=("third molar") OR ALL=("third molars") OR ALL=("wisdom teeth") OR ALL=("wisdom tooth") AND ((ALL=(cellulose)) OR ALL=(Reso-Pac)) OR ALL=(myrrh)
Embase	4	('third molar surgery'/exp OR ('third molar'/exp OR 'molar, third' OR 'third molar teeth' OR 'third molar tooth' OR 'third molars' OR 'wisdom teeth' OR 'wisdom tooth')) AND ('Reso-Pac' OR ('cellulose'/exp OR 'alpha cellulose' OR 'cellulose column' OR 'cellulose polymer' OR 'qae cellulose') OR 'myrrh extract'/exp)
Google scholar	10	("third molar" OR "wisdom teeth") AND ("Reso-Pac" OR "cellulose" OR "myrrh")

### Screening of articles

Duplicate articles were identified and removed after pooling data from multiple databases, based on similarities in title, author, and publication year. Deduplication and screening for inclusion was conducted using Rayyan software by two independent reviewers (S.R. and G.S.). Studies that did not meet the pre-specified PICOS criteria were excluded upon title and abstract level screening through mutual agreement. Any discrepancies during the selection process were resolved through discussion, along with input from a third reviewer (S.S.) when necessary. Then, full-text screening of eligible studies was then independently performed by S.R. and G.S., with disagreements once again resolved through discussion (Fig. 1).

### Data extraction

For studies meeting the eligibility criteria, data extraction was performed independently by two authors (S.R. and G.S.), capturing the following key parameters: (a) author and year, (b) study location, (c) study design, (d) type of impaction, (e) sample size, (f) test group, (g) control group, (h) outcome measures, (i) results, (j) statistical significance, and (k) inference.

### Risk of bias

The risk of bias in the included randomized controlled trials was evaluated using the Cochrane Risk of Bias tool (RoB 2.0). Two independent reviewers (S.R. and G.S.) conducted this assessment, with any disagreements resolved through consultation with a third reviewer (S.S.).

### Effect measure and statistical analysis

A comprehensive meta-analysis was conducted using JASP software [11] to quantitatively evaluate the outcomes from systematically reviewed studies. The primary outcomes assessed were reduction in pain scores and wound healing, analysed separately to determine their respective efficacies. The decision to prioritize these as a significant outcome was influenced by its recurrent mention in the selected articles, indicating its relevance and impact. Reso-Pac application following surgical removal of mandibular impacted third molars was compared with

the use of a gauze pack to assess improvements in wound healing. Due to the anticipated heterogeneity among the included studies, a random effects model was employed. To further address the heterogeneity and to enhance the robustness of the findings, Bayesian meta-analysis was conducted using JASP software.

### GRADE approach

The certainty of the evidence was assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) framework using the online software GRADEpro GDT (<https://grade.pro.org/>). This approach considers five key domains: risk of bias, inconsistency, indirectness, imprecision, and publication bias. Two clinically relevant outcomes were evaluated, pain reduction (measured using the Visual Analog Scale [VAS]) and wound healing (assessed using the Modified Landry's Wound Healing Scale). Data extracted from eligible randomized controlled trials (RCTs), and standardized mean differences (SMD) with 95% confidence intervals (CI) was calculated to estimate the effect size of Reso-Pac compared to placebo or other pharmacological interventions.

## Results

### Study selection

The two stage process of screening resulted in the inclusion of four articles for review [3, 12–14]. Of these, three studies with comparable outcomes were selected for quantitative evidence synthesis, and their results are represented in a forest plot [3, 12, 14].

### General characteristics

Following a thorough screening process four articles were deemed eligible for data extraction (Fig. 1). The primary tools used for outcome evaluation across these studies were the Visual Analog Scale (VAS) for pain assessment, employed in all four articles, and variations of Landry's wound healing scale. Two studies used a modified version of Landry's scale [3, 14], while two employed the original scale [12, 13] to assess wound healing progress. Furthermore, all studies ensured that both the test and control groups received a standardized management protocol

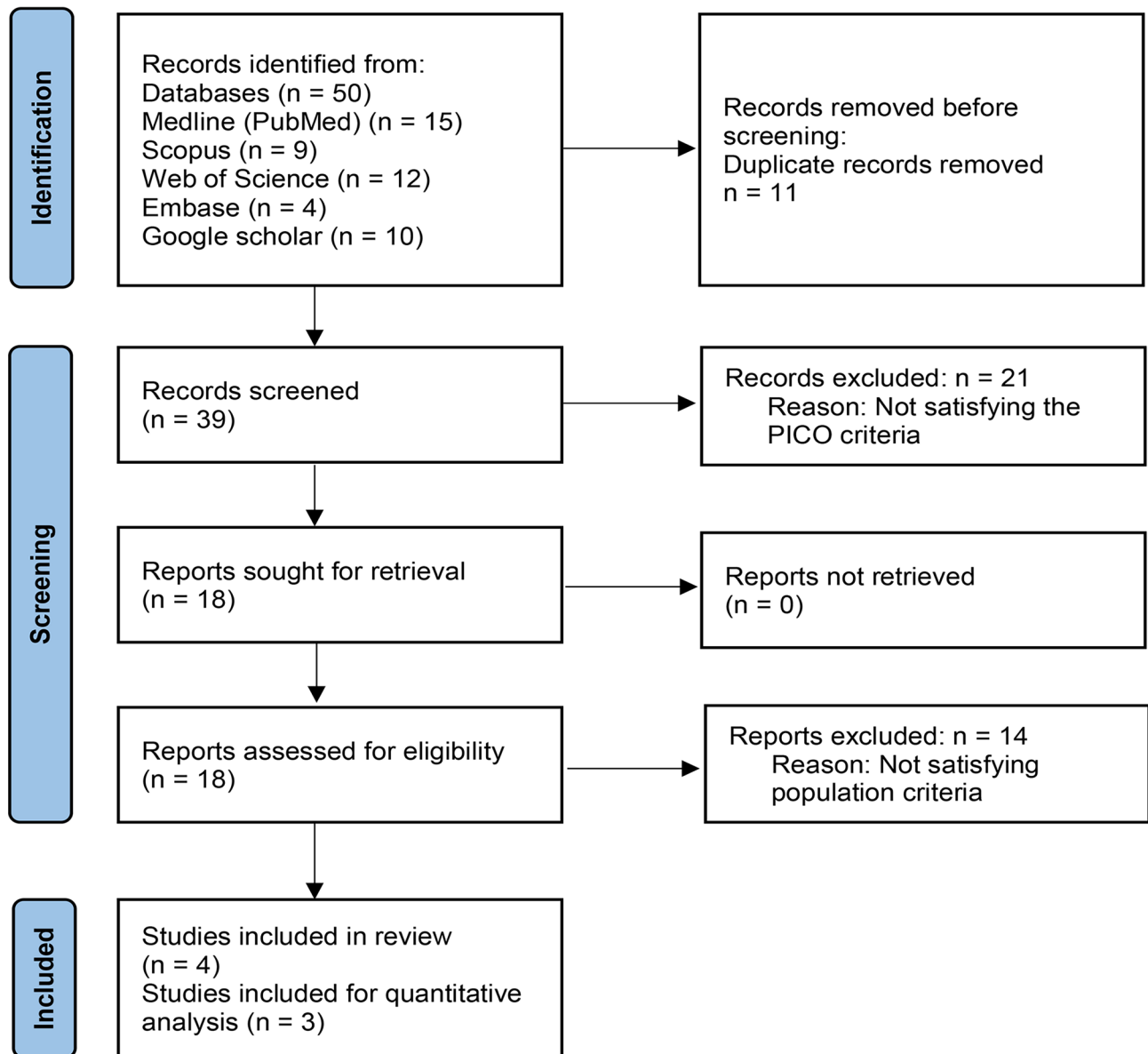


Fig. 1 PRISMA Flow chart

consisting of antibiotics and analgesics. The dosage regimens were kept consistent across both groups to ensure a reliable assessment of Reso-Pac’s efficacy (Table 2).

**Main outcome of the study**

Table 3 presents a comprehensive summary of outcome measures extracted from the studies encompassed in the review. Pain and wound healing scores meticulously delineated within the results section. In the context of this study, the surgical removal of impacted mandibular third molars were used as the benchmark for assessing both pain and wound healing. Notably, with the exception of one study, all others included in the review displayed a significant and statistically noteworthy disparity

in pain and wound healing scale. This trend favoured the use of Reso-Pac over a placebo gauze pack.

**Risk of bias assessment**

Figures 2 and 3 illustrate the risk of bias assessments for individual studies and the overall summary graph for wound healing and pain assessment parameters, respectively, using the Cochrane Risk of Bias 2.0 tool for randomized controlled trials. The visualizations were generated using the Risk of Bias Visualization (RoB-vis) tool [15]. The interrater reliability was high, with a Kappa score of 0.89, indicating strong agreement among reviewers.

**Table 2** General characteristics of studies included

S.no	Author, year	Study location	Study design*	Type of impaction	Sample size	Test group (n)	Control group (n)
1	Raghavan, S L., et al., 2020 [3]	Chennai	RCT	Class 1 Position A Mesio-angular/Vertical	100	Reso-Pac (50)	Gauze pack (50)
2	Gorrela., et al., 2022 [12]	Telangana	Split mouth RCT	Class 1 Position A Mesioangular	50	Reso-Pac (50)	Gauze pack (50)
3	MK Lavanya; et al., 2023 [13]	Chennai	RCT	NS*	30	Reso-Pac (15)	Standard care with chlorhexidine mouthwash (15)
4	Pravallika, A., et al., 2024 [14]	Bangalore	RCT	NS*	50	Reso-Pac (25)	Gauze pack (25)

\*NS: Not Specified, RCT: Randomized controlled trial

**Table 3** Main outcome and inference from included studies

S.no	Author, year	Outcome measures	Results (on day 7)				Significance	Inference
			Pain		Wound healing			
			Test	Control	Test	Control		
1	Raghavan, S L., et al., 2020 [3]	<b>Pain</b> - VAS <b>Wound healing</b> - Modified Landry's wound healing scale	0	1.04 (1.293)	5.0 (0)	4.0 (0.756)	< 0.001	Reso-Pac promoted wound healing and improved patients comfort during the postoperative phase
2	Gorrela., et al., 2022 [12]	<b>Pain</b> - VAS <b>Wound healing</b> - Landry's scale	0.04	1.38 (0.49)	5.0 (0)	4.06 (0.37)	< 0.001	Reso-Pac serve to be an effective role as an intraoral dressing after surgical removal of impacted teeth which improves patient comfort postoperatively by protecting the surgical wound, reducing the post-operative pain and enabling excellent wound healing.
3	MK Lavanya; et al., 2023 [13]	<b>Wound healing</b> - Landry's wound healing scale			Very good - 40% Excellent - 46.7%	Very good - 46.7% Excellent - 13.3%	0.16	Study supports Reso-Pac, but further comparative studies with larger sample size with longer follow up are required to come to a definitive conclusion.
4	Pravallika, A., et al., 2024 [14]	<b>Pain</b> - VAS <b>Wound healing</b> - Modified Landry's wound healing scale	0.20	4.36 (1.31)	Poor- 0.0% Good- 4.0% Very good- 16.0% Excellent- 80.0%	Poor- 68.0% Good- 28.0% Very good- 4.0% Excellent- 0.0%	0.001	Reso-Pac is a new dressing material of choice, which can be preferred over all other dressing materials for a better patient comfort and wound healing.

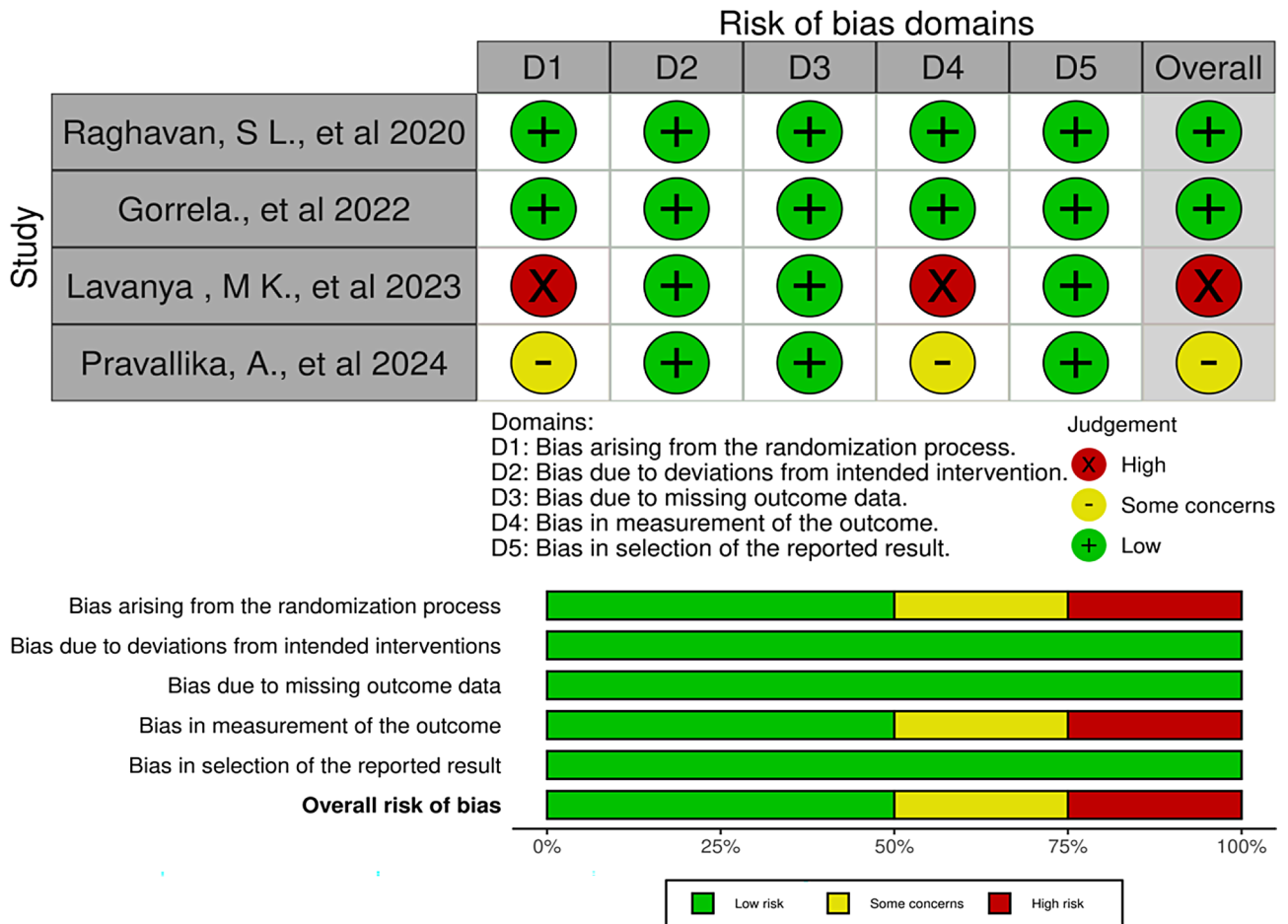
Among the four studies assessing wound healing, 50% exhibited a low risk of bias, while 25% had a moderate and high risk of bias. One study [13] demonstrated an overall high risk of bias, which influenced the cumulative bias summary. Additionally, none of the included studies provided a clear description of the blinding process for outcome assessment, raising concerns about potential detection bias. However, attrition bias was minimal, with negligible loss to follow-up reported. For pain assessment, three studies were evaluated, all of which exhibited an appreciably low risk of bias. Despite certain methodological limitations, the overall risk of bias was deemed moderate, suggesting that while the findings should be interpreted with caution, they remain generally robust and reliable.

## Quantitative synthesis

### Pain parameter evaluation

A meta-analysis was conducted using JASP software to generate forest plots for two key outcome parameters: pain reduction and wound healing. Of the four included studies, three [3, 12, 14] provided relevant data for pain reduction, and were thus included in the analysis. The study by Lavanya et al. [13], which focused solely on wound healing as measured by Landry's scale, did not evaluate pain, as confirmed through direct communication with the authors. Consequently, this study was excluded from the pooled statistical analysis for pain.

Quantitative analysis was performed using Cohen's d as the effect estimate, calculated from the mean and standard deviation of the test and control groups using the Campbell Collaboration effect size calculator [16]. The



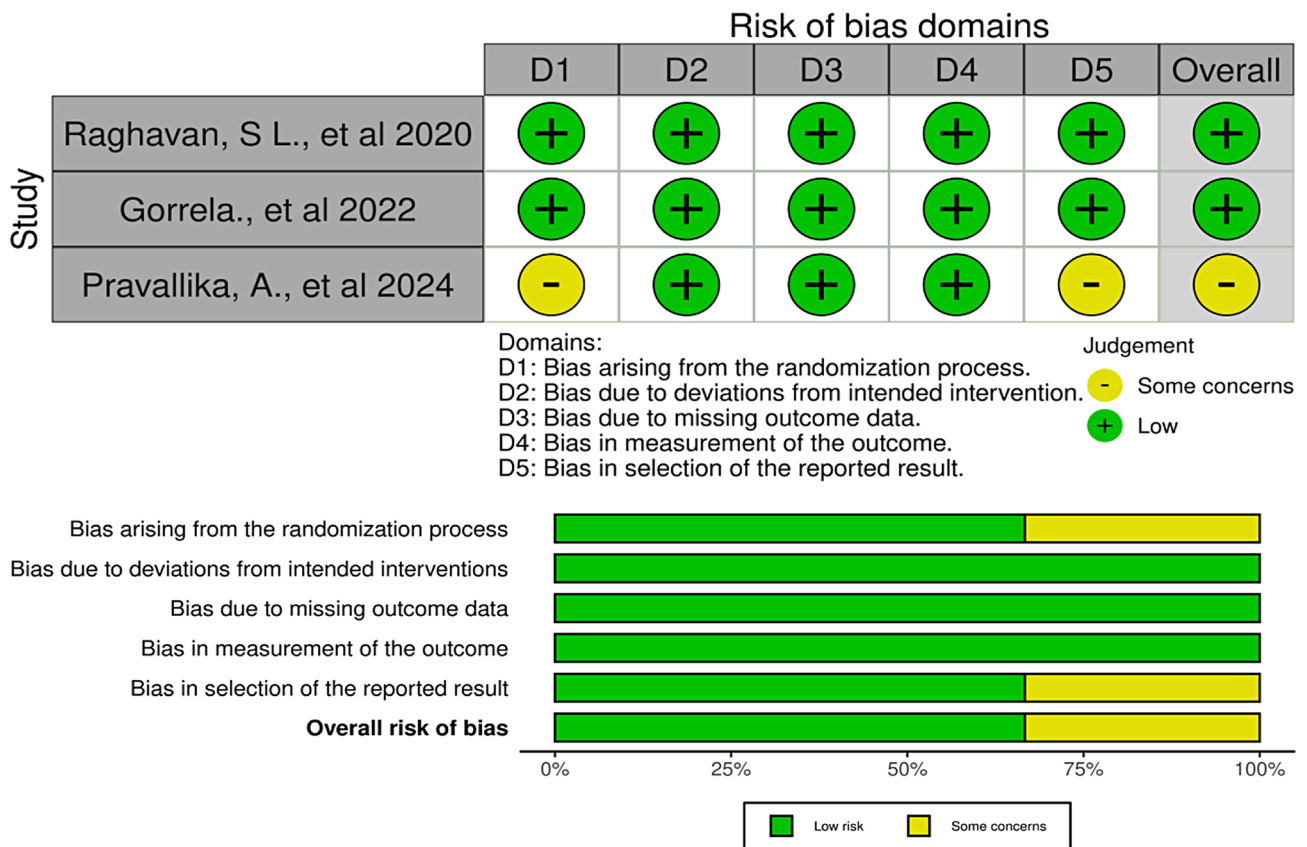
**Fig. 2** Risk of bias assessment and summary graph for studies evaluating wound healing parameters

results revealed a significantly greater reduction in pain on the 7th postoperative day with Reso-Pac compared to gauze pack controls (random-effects pooled estimate = -2.79; 95% Confidence Interval: -4.18 to -1.40) (Fig. 4). Fit measures from the maximum likelihood model further supported the adequacy of the meta-analysis. A log-likelihood value of -4.835 and deviance of 10.999 suggested reasonable model fit, while the Akaike Information Criterion (AIC) of 13.670 and Bayesian Information Criterion (BIC) of 11.867 indicated strong model specification, with lower values representing a better fit.

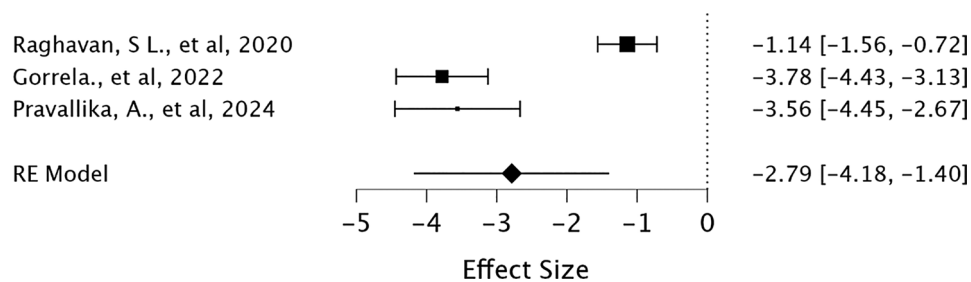
**Bayesian meta-analysis**

To address the heterogeneity more rigorously, a Bayesian meta-analysis was performed, incorporating all studies without exclusion. Markov Chain Monte Carlo (MCMC) simulations were used to estimate effect sizes by sampling from the posterior distribution, integrating prior knowledge with observed data. Summary estimates were generated from these samples and compared to observed values, strengthening the evidence base. The Bayesian analysis produced a Bayes Factor (BF10) of 3.208,

indicating moderate evidence in favor of the alternative hypothesis (i.e., Reso-Pac reduces postoperative pain) relative to the null hypothesis. The Bayesian random-effects model estimated a mean ( $\mu$ ) effect size of -1.834 (95% credible interval: -3.89 to 0.46) (Fig. 5). This negative pooled effect size suggests a significant reduction in pain favoring Reso-Pac, though the credible interval crosses the line of no effect, indicating potential inconsistencies in the treatment’s efficacy for pain reduction. Despite this minor overlap, the Bayesian model demonstrated a high degree of consistency between estimated and observed effect sizes, with minimal variability. This consistency enhances the credibility of the findings, indicating that the observed effects are likely reflective of true treatment patterns rather than random chance. Overall, the results provide moderate support for the conclusion that Reso-Pac effectively reduces pain following third molar surgery. The robust and consistent effect size estimates reinforce the reliability of the conclusions drawn from both the frequentist and Bayesian meta-analytic frameworks.



**Fig. 3** Risk of bias assessment and summary graph for studies evaluating pain parameters



**Fig. 4** Random effect model forest plot graph for the parameter of pain reduction

**Wound healing parameter evaluation**

A meta-analysis was performed to evaluate the effects of Reso-Pac dressing on wound healing using Landry’s wound healing scale. Out of the four studies included in the review, two provided comparable outcome measures for wound healing and were included in the quantitative analysis [3, 12]. The remaining two studies [13, 14] reported wound healing as a percentage of the population categorized using an ordinal scale, ranging from poor to excellent, and were therefore excluded from the meta-analysis.

Quantitative analysis was performed using Cohen’s d as the effect size estimate which revealed a significantly greater improvement in wound healing on the 7th day

post-Reso-Pac application compared to gauze pack controls. The random-effects pooled estimate was 2.71 (95% Confidence Interval: 1.52 to 3.89) (Fig. 6). Fit measures from the maximum likelihood model indicated a good fit for the meta-analysis, with a Log-Likelihood value of -2.524 and Deviance of 6.506. Additionally, the Akaike Information Criterion (AIC) value of 9.048 and Bayesian Information Criterion (BIC) value of 6.434 suggested that the model was well-specified, with lower values representing a better fit. Although substantial heterogeneity was observed ( $I^2 = 89.04\%$ ), further analyses to explore the heterogeneity were not conducted due to the limited number of studies (only two). Despite the observed heterogeneity, the confidence intervals were significantly

distant from the line of no effect, indicating that the heterogeneity did not undermine the robustness of the results.

The findings clearly demonstrate that Reso-Pac significantly enhances wound healing on the 7th postoperative day when compared to controls. The observed effect sizes, showing negative values for pain reduction and positive values for wound healing, further support the efficacy of Reso-Pac in improving clinical outcomes following the surgical removal of impacted mandibular third molars.

**Certainty of evidence**

The certainty of evidence was assessed using established criteria including inconsistency, indirectness, imprecision, and risk of bias, resulting in high-certainty ratings for both pain reduction and wound healing outcomes. Based on data from three randomized controlled trials (RCTs) on pain reduction and two RCTs on wound healing, Reso-Pac demonstrates a significantly greater effectiveness compared to placebo or other drug treatments in reducing pain and promoting postoperative wound healing in patients undergoing surgical extraction of

impacted mandibular third molars. These findings reflect a moderate level of certainty (Table 4). For pain reduction, patients treated with Reso-Pac showed an SMD of 2.79 points higher (95% CI: 1.4 to 4.18) on the VAS scale compared to the control group, indicating a clinically meaningful reduction in postoperative pain. Similarly, wound healing was improved by 2.71 points (95% CI: 1.52 to 3.89) on the Modified Landry’s Wound Healing Scale, suggesting enhanced tissue recovery within seven days. Despite these benefits, the certainty of evidence was downgraded to moderate due to concerns regarding randomization bias and substantial heterogeneity among studies.

**Discussion**

This review focuses on the management of intraoral wounds after the surgical extraction of impacted mandibular third molars, emphasizing conservative approaches such as the application of intraoral dressings, particularly Reso-Pac, to protect the wound from physical, thermal, or microbial insults, thus promoting optimal healing at the surgical site. The review examines four studies that evaluate Reso-Pac’s effectiveness compared to placebos

**Table 4** GRADE summary of findings table

**Reso-Pac compared to placebo/ any drugs in alleviating pain and in improving postoperative wound healing among patients undergoing surgical extraction of impacted mandibular third molars**

**Patient or population:** Third molar extracted patients

**Intervention:** Reso-Pac

**Comparison / Control:** Placebo/ any drugs

Outcomes	No. of participants (studies)	Follow up	Certainty of the evidence (GRADE)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Anticipated absolute effects with 95% CI* Effect difference of Reso-Pac with comparator / control
<b>Reduction in pain</b> (VAS scale: 1 to 10)	250 (3 RCTs)	7 days	⊕⊕⊕○ Moderate <sup>a, b</sup>	Randomization concerns	Substantial heterogeneity	No indirectness	Not serious <sup>c</sup>	SMD <b>2.79 higher</b> (1.4 to 4.18)
<b>Wound Healing</b> (Modified Landry’s wound healing scale: 1 to 5)	200 (2 RCTs)	7 days	⊕⊕⊕○ Moderate <sup>a, b</sup>	Randomization concerns	Substantial heterogeneity	No indirectness	Not serious <sup>c</sup>	SMD <b>2.71 higher</b> (1.52 to 3.89)

\*The effect in the intervention group (and its 95% confidence interval) is based on the assumed effect in the comparison group and the relative effect of the intervention.

CI: confidence interval

**GRADE Working Group grades of evidence**

**High certainty:** we are very confident that the true effect lies close to that of the estimate of the effect.

**Moderate certainty:** we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

**Low certainty:** our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

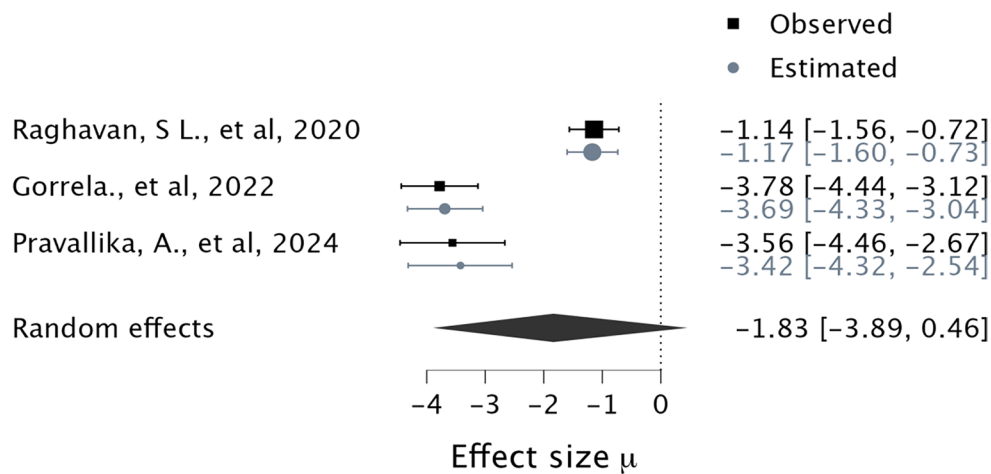
**Very low certainty:** we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

**Explanations**

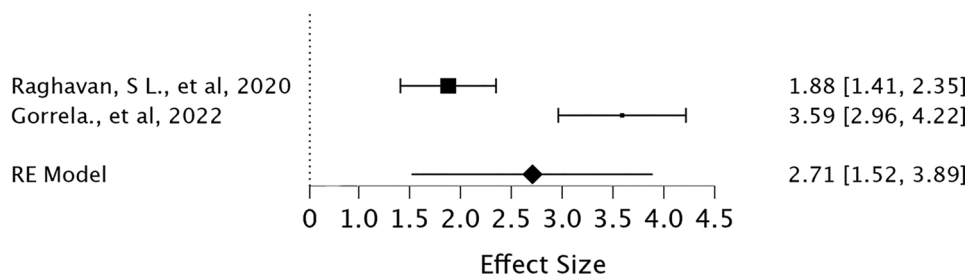
a. Bias exists at the stage of randomization

b. Substantial heterogeneity exceeding 75% across three studies in the analysis, an Egger’s intercept value of 10.49 along with a p-value of 0.03 indicates the presence of publication bias

c. Wider confidence interval yet the line of no effect is not interrupted



**Fig. 5** Bayesian Forest plot graph with observed and estimated effect sizes



**Fig. 6** Random effect model forest plot graph for the parameter of improvement in wound healing

or alternative medications in reducing postoperative pain and enhancing wound healing. However, one study was excluded from the pain analysis [13], and two studies were omitted from the wound healing analysis due to significant variability in the outcome measures [13, 14].

Although the number of included studies was limited and from the same country, the consistent outcomes justified a quantitative synthesis. A Bayesian meta-analysis was employed to enhance estimate reliability and address potential heterogeneity, even with sparse data. Our quantitative synthesis revealed a significant reduction in postoperative pain with Reso-Pac compared to standard gauze pack controls. The pooled effect estimate of -2.79 (Fig. 4) suggests that patients treated with Reso-Pac experienced markedly less pain, with the considerably substantial effect size. To ensure the robustness of these findings, Bayesian meta-analysis was also conducted, yielding a pooled estimate of -1.83 (Fig. 5), further reinforcing the effectiveness of Reso-Pac in alleviating postoperative pain following third molar extractions. In terms of wound healing, Reso-Pac demonstrated a significant advantage, with a pooled estimate of 2.71 on the seventh postoperative day compared to controls (Fig. 6). These outcomes highlight Reso-Pac’s clinical superiority in both pain reduction and wound healing.

Despite these positive findings, the analysis identified potential publication bias and heterogeneity, particularly concerning the pain reduction parameter, which could affect the interpretation of the results. Nevertheless, the Bayesian meta-analysis continued to support Reso-Pac’s efficacy, demonstrating a moderate effect size. However, the credible interval limits did cross the line of no effect, indicating some uncertainty. The risk of bias evaluation across the included studies indicated a predominance of low to moderate risk, with only 25% of studies exhibiting high risk (Fig. 3). While these limitations must be acknowledged, the overall evidence is robust and supports the clinical use of Reso-Pac, albeit with some caution due to potential bias in study randomization.

Reso-Pac apart from being used in third molar surgeries gain a significant focal point attention in periodontal procedures, surpassing its exploration in impaction-related surgeries. Notably, Gopikrishnan et al. [17] compared Reso-Pac with Coe-Pak™ following gingivectomy, demonstrating superior healing with Reso-Pac by day 3, a trend that continued through days 7 and 14. By days 21 and 28, both dressings showed comparable outcomes, signifying complete healing. Reso-Pac was notable for its ease of application, reduced plaque accumulation, and overall superior healing. This study, which included a one-month follow-up, marks a significant advancement in the field.

Similarly, Kazwini et al. [18] evaluated Reso-Pac and Coe-Pak after surgical removal of gingival pigmentation, with Reso-Pac showing slightly better healing at 1 and 2 weeks, although these differences were not statistically significant.

The findings of Gholami et al. [19] further support Reso-Pac's use in periodontal surgery, comparing it to Coe-Pak after flap surgery. Reso-Pac was found to be clinically equivalent to Coe-Pak but offered additional benefits, such as reduced plaque accumulation and granulation tissue formation. Moreover, Reso-Pac demonstrated superior biocompatibility, with fewer cytotoxic effects on human gingival fibroblasts during the initial postoperative period. Furthermore, Kadkhodazadeh et al. [20] conducted an in vitro study, found that Reso-Pac exhibited lower cytotoxicity on fibroblast cells than Coe-Pak. Petelin et al. [21] also compared Reso-Pac with several periodontal dressings (including Barricaid, Coe-Pak, Fittydent, Mycotect, and Peripac), concluding that Reso-Pac promoted superior epithelialization and vascularization with minimal inflammatory response within the first four postoperative days, making it the most suitable periodontal dressing in their assessment. Consequently, Reso-Pac emerged as the most suitable periodontal dressing based on their evaluation.

While this review emphasizes Reso-Pac's role in managing wounds following mandibular third molar extractions, the evidence also suggests its potential applicability across a broader range of oral surgical procedures. Despite efforts to address the limitation of a small sample size through various methodological approaches, the relatively limited number of included studies, along with heterogeneity in study designs, may restrict the generalizability of these findings. Further research is essential to refine the clinical use of Reso-Pac and confirm its efficacy in diverse patient populations. Nevertheless, Reso-Pac remains a promising treatment option. Its use as an intraoral dressing, combined with the absence of significant adverse effects, highlights its potential as an effective therapeutic approach for managing wounds after the surgical extraction of impacted mandibular third molars. Continued investigation is warranted to validate and enhance these findings across different populations. Nonetheless, the evident benefits of Reso-Pac as an intraoral bandage underscore its importance and relevance in advancing the field of oral surgery.

## Conclusion

This systematic review and meta-analysis confirm that Reso-Pac significantly reduces postoperative pain and promotes wound healing following the surgical extraction of impacted mandibular third molars. It demonstrates superiority over conventional treatments, highlighting its potential as a promising option for intraoral wound

management. However, certain limitations, including methodological heterogeneity and a limited number of studies, should be considered. While the evidence strongly supports its effectiveness in wound healing, the subjective assessment of pain reduction was not highly significant.

## Author contributions

S.S and S.R involved in conceptualisation and drafting of the manuscript. G.S involved in preparing figures and in proof correction. All authors reviewed the manuscript.

## Funding

The authors have not declared any specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

## Data availability

No datasets were generated or analysed during the current study.

## Declarations

### Ethical approval

The study did not require ethics approval because this study is exclusively based on published literature.

### Patient consent for publication

Not applicable.

### Protocol registration

The study protocol can be accessed through the International Prospective Register of Systematic Reviews, the PROSPERO database with the following register number: CRD42024541873.

### Patient and public involvement

It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

### Competing interests

The authors declare no competing interests.

### Author details

<sup>1</sup>Sree Balaji Dental College and Hospital, Velachery Main Rd,

Narayanapuram, Pallikaranai, Chennai, Tamil Nadu 600100, India

<sup>2</sup>Ragas Dental College and Hospital, Chennai, Tamil Nadu 600119, India

<sup>3</sup>Discovery Research Division, Indian Council of Medical Research ICMR Headquarters, Ansari Nagar, New Delhi 110029, India

Received: 15 July 2024 / Accepted: 23 June 2025

Published online: 23 August 2025

## References

- Peterson LJ. Antibiotic prophylaxis against wound infections in oral and maxillofacial surgery. *J Oral Maxillofac Surg.* 1990;48:617–20.
- Cousin AS, Bouletreau P, Giai J, et al. Severity and long-term complications of surgical site infections after orthognathic surgery: a retrospective study. *Sci Rep* 2020. 2020;10:1.
- Raghavan SL, Panneerselvam E, Mudigonda SK, et al. Protection of an intraoral surgical wound with a new dressing: a randomised controlled clinical trial. *Br J Oral Maxillofac Surg.* 2020;58:766–70.
- Surgery M, Al-Amiri AQ. Evaluation of the haemostatic evaluation of the haemostatic action of povidone-iodine in dental extraction (Clinical and follow up prospective study). *J Bagh Coll Dentistry*; 24: 2012.
- Funahara M, Yanamoto S, Ueda M, et al. Prevention of surgical site infection after oral cancer surgery by topical Tetracycline. *Med (United States)*. 2017;96(Epub ahead of print 1 December). <https://doi.org/10.1097/MD.00000000000008891>.

6. Reekie D, Downes P, Devlin CV, et al. The prevention of 'dry socket' with topical metronidazole in general dental practice. *Br Dent J* 2006. 2006;200:4.
7. Sivalingam VP, Panneerselvam E, Raja KVB et al. Does Topical Ozone Therapy Improve Patient Comfort After Surgical Removal of Impacted Mandibular Third Molar? A Randomized Controlled Trial. *Journal of Oral and Maxillofacial Surgery*. 2017; 75: 51.e1-51.e9.
8. Giridhar Vu. Role of nutrition in oral and maxillofacial surgery patients. *Natl J Maxillofac Surg*. 2016;7:3.
9. Keerthi R, Vaibhav N, Raut R. Amniotic membrane as a biological scaffold after vestibuloplasty. *J Maxillofac Oral Surg*. 2015;14:383–7.
10. Farooqui MK, Siddiqui R, Soni K et al. Role of collagen membrane in the treatment of advanced stage of oral submucous fibrosis: A case report. *Scholarsmepub.com*. <https://doi.org/10.21276/sjodr>
11. JASP Team. JASP (Version 0.19.1) [Computer software]. Amsterdam, Netherlands: University of Amsterdam; 2024.
12. Gorrela H, Siripuram H, Sirivore A. Role of Reso-Pac as an intraoral dressing material for the surgical wound: A randomized controlled clinical trial. *J Oral Biol Craniofac Res*. 2022;12:604–9.
13. Lavanya MK, Arun M. Intraoral surgical wound dressing Reso-Pac. *J Clin Otor*. 2023;27(1):5279–87.
14. Pravalika A, Menon S, Sham ME et al. Efficacy of Reso-Pac in wound healing after surgical removal of impacted mandibular third molars: A clinical study. *J Maxillofac Oral Surg* 2024; 1–7.
15. McGuinness LA, Higgins JPT. Risk-of-bias visualization (robvis): an R package and Shiny web app for visualizing risk-of-bias assessments. *Res synth methods*; n/a. Epub ahead of print 26 April 2020. <https://doi.org/10.1002/jrsm.1411>
16. Wilson DB. May, PhD (n. d.). Practical Meta-Analysis Effect Size Calculator [Online calculator]. <https://www.campbellcollaboration.org/research-resources/effect-size-calculator.html> (accessed 22 2024).
17. Gopikrishnan Nair G, Shetty SK, Kulloli A, et al. Comparative evaluation of wound healing outcomes between Reso-Pac® and Coe-Pak™ following conventional gingivectomy. *J Popul Ther Clin Pharmacol*. 2023;30:216–24.
18. Rudwan Kazwini TK. Comparison between absorbable dressing (Reso-Pac®) and eugenol-free dressing (Coe-pak) after surgical removal of gingival pigmentation.
19. Gholami L, Ansari-Moghadam S, Sadeghi F, et al. Clinical and cytotoxic comparison of two periodontal dressings after periodontal flap surgery. *World J Dentistry*. 2019;10:7–13.
20. Kadkhodazadeh M, Baghani Z, Torshabi M, et al. In vitro comparison of biological effects of Coe-Pak and Reso-Pac periodontal dressings. *J Oral Maxillofac Res*. 2017;8:1–3.
21. Petelin M, Pavlica Z, Batista U, et al. Effects of periodontal dressings on fibroblasts and gingival wound healing in dogs. *Acta Vet Hung*. 2005;52:33–46.

### Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.