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Research Article

Effect of Pre-Prosthetic Surgical Alveoloplasty on Post-Prosthetic Mucosal Pathologies, Denture Retention, and Stability in Complete Denture Patients: A Systematic Review and Meta-Analysis

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ABSTRACT
Background: Pre-prosthetic surgical alveoloplasty is widely taught and practised as a means of optimising the alveolar ridge before complete denture fabrication, yet the degree to which it measurably improves post-prosthetic mucosal health, retention, and stability compared with denture fabrication without alveoloplasty has not been systematically established.
Objectives: This systematic review aimed to evaluate the effect of pre-prosthetic surgical alveoloplasty, relative to no alveoloplasty, on post-prosthetic mucosal pathology, denture retention, and denture stability in adult complete denture patients.
Methods: PubMed, Embase, the Cochrane Library, Web of Science, and Scopus were searched from January 2010 to June 2026 for randomised controlled trials and comparative cohort studies. Two reviewers independently screened records, extracted data, and assessed methodological quality using RoB 2 and ROBINS-I. A random-effects meta-analysis was planned a priori, with heterogeneity to be quantified using the I^2 statistic and publication bias to be assessed via funnel plot and Egger's test where a sufficient number of studies permitted.
Results: The search identified 118 records, of which 9 underwent full-text review. No randomised controlled trial or comparative cohort study directly comparing alveoloplasty with no alveoloplasty for mucosal pathology, retention, or stability outcomes met inclusion criteria; all excluded full texts lacked a concurrent non-surgical comparator or did not measure the outcomes of interest. Consequently, quantitative meta-analysis could not be performed for any outcome domain. A narrative synthesis of indirect and descriptive evidence, including single-arm case series and cross-sectional prevalence data, is presented in place of pooled effect estimates, following Synthesis Without Meta-analysis (SWiM) reporting guidance.
Conclusions: No controlled comparative evidence currently exists to confirm or refute the clinical benefit of pre-prosthetic alveoloplasty for post-prosthetic mucosal health, retention, or stability. Current practice rests on biomechanical rationale and uncontrolled case series rather than comparative trial evidence, representing a substantial evidence gap that adequately powered comparative studies should address.

Keywords: Alveoloplasty, Pre-Prosthetic Surgery, Complete Denture, Denture Retention, Denture Stability, Oral Mucosal Pathology, Systematic Review.

INTRODUCTION

Complete denture prosthodontics remains a cornerstone of oral rehabilitation for edentulous patients, and the long-term success of a complete denture is strongly influenced by the anatomical quality of the underlying alveolar ridge. Progressive residual ridge resorption, irregular bony contours, sharp mylohyoid ridges, prominent genial tubercles, and hyperplastic or hypermobile soft tissue can all compromise the fit, retention, and stability of a complete denture and predispose the overlying mucosa to trauma and pathological change.

Pre-prosthetic surgical alveoloplasty, involving the recontouring or selective removal of bony irregularities of the alveolar process, has long been advocated as a means of optimising the denture-bearing foundation before prosthesis fabrication. Its stated goals include the elimination of undercuts and sharp bony margins, the creation of a broad and uniform ridge contour, and the consequent improvement of denture retention, stability, and mucosal tolerance of functional loading. Despite its widespread inclusion in oral and maxillofacial surgery and prosthodontic curricula, the evidentiary basis for these claimed benefits derives substantially from biomechanical principles, expert opinion, and uncontrolled case series rather than from comparative clinical trials.

This distinction matters clinically because alveoloplasty is an irreversible procedure that permanently reduces alveolar bone volume, a consideration of particular importance given the increasing role of the residual ridge as a foundation for future implant-retained prostheses. If the clinical benefit of alveoloplasty for conventional complete denture outcomes were found to be modest or unproven by controlled evidence, this would carry direct implications for patient counselling and case selection, particularly in patients who may later pursue implant-supported rehabilitation.

This systematic review therefore aimed to identify and synthesise the available comparative evidence, published between January 2010 and June 2026, evaluating the effect of pre-prosthetic surgical alveoloplasty, relative to no alveoloplasty, on three pre-specified outcome domains in complete denture patients: post-prosthetic mucosal pathology, denture retention, and denture stability.

METHODS

Protocol and Registration

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement. The review protocol, including eligibility criteria, search strategy, and planned analyses, was defined a priori before screening commenced.

Eligibility Criteria

Eligible studies enrolled adult complete denture patients (aged 18 years or older) and compared pre-prosthetic surgical alveoloplasty with no alveoloplasty (or with a delayed-loading, non-surgical, or conservative comparator) prior to complete denture fabrication. Eligible designs comprised randomised controlled trials and comparative cohort studies (prospective or retrospective) reporting at least one of the following outcomes: post-prosthetic mucosal pathology (including denture-related stomatitis, traumatic ulceration, or hyperplastic lesions), denture retention, or denture stability, whether measured objectively or through validated patient-reported instruments. Studies were excluded if they lacked a concurrent non-surgical comparator, compared only between alternative surgical techniques without a no-surgery arm, enrolled implant-supported or partially dentate populations without a separable complete denture subgroup, or reported outcomes in a format not amenable to extraction.

Search Strategy

A systematic electronic search was conducted across PubMed, Embase, the Cochrane Library, Web of Science, and Scopus, restricted to the period from January 2010 to June 2026. Search terms combined controlled vocabulary and free-text terms for "alveoloplasty," "pre-prosthetic surgery," "complete denture," "denture retention," "denture stability," and "oral mucosal lesions," combined using Boolean operators. Reference lists of retrieved narrative reviews and textbook chapters were hand-searched to identify additional potentially eligible primary studies. No language restriction was applied at the search stage.

Study Selection

Titles and abstracts were screened independently by two reviewers against the eligibility criteria, followed by full-text review of potentially eligible records. Disagreements were resolved by discussion, with a third

reviewer consulted where consensus could not be reached. The study selection process was documented in a PRISMA 2020 flow diagram format, recording the number of records identified, duplicates removed, records screened, full texts assessed for eligibility, studies excluded with reasons, and studies retained for synthesis.

Data Extraction

A standardised, piloted data extraction form was used to capture study characteristics (author, year, country, design, sample size, and focus) and, for studies approaching eligibility, outcome data relevant to mucosal pathology, retention, and stability. Data extraction was performed independently by two reviewers and cross-checked for accuracy, with disagreements resolved by consensus.

Quality Assessment

Had eligible randomised controlled trials been identified, methodological quality was to be assessed using the Cochrane Risk of Bias 2 (RoB 2) tool; eligible non-randomised comparative cohort studies were to be assessed using the ROBINS-I tool. In the absence of eligible comparative studies, quality appraisal was instead applied descriptively to the single-arm case series and cross-sectional studies informing the narrative synthesis, using relevant domains of the Joanna Briggs Institute critical appraisal checklists for case series and cross-sectional studies, to characterise the overall strength of the indirect evidence base.

Statistical Analysis

Meta-analysis was planned a priori using inverse-variance methods for continuous outcomes (weighted mean difference) and Mantel-Haenszel methods for dichotomous outcomes (risk ratio), with heterogeneity to be quantified using the I^2 statistic and a random-effects model to be applied given the anticipated clinical and methodological heterogeneity across study designs. Publication bias was to be assessed through funnel plot inspection and Egger's regression test where ten or more studies contributed to a given outcome, and sensitivity analyses were planned by excluding individual studies and by restricting analyses to randomised controlled trial data. As no studies meeting the comparative eligibility criteria were identified for any outcome domain, none of these quantitative analyses could be executed; this methodological infrastructure is reported in full for transparency and to guide the interpretation of, and pre-registration for, future updates of this review as new comparative evidence emerges. In place of meta-analysis, findings from indirect and descriptive studies were synthesised narratively in accordance with Synthesis Without Meta-analysis (SWiM) reporting guidance.

RESULTS

Study Selection

The electronic search across PubMed, Embase, the Cochrane Library, Web of Science, and Scopus identified 118 records. After removal of 34 duplicates, 84 records were screened by title and abstract, of which 66 were excluded as clearly irrelevant (addressing implant surgery, orthognathic surgery, or paediatric populations). The remaining 18 records underwent full-text review; of these, 9 records were retained as sources of indirect or descriptive evidence, while 9 additional records were excluded primarily for lacking a concurrent non-surgical comparator or for reporting outcomes outside the pre-specified domains. Critically, no randomised controlled trial or comparative cohort study directly comparing alveoloplasty with no alveoloplasty on post-prosthetic mucosal pathology, retention, or stability met the pre-specified eligibility criteria for quantitative synthesis. This review is therefore reported, consistent with Cochrane guidance for reviews without eligible comparative studies, as an evidence-gap analysis supported by narrative synthesis of the closest available indirect evidence.

Study Characteristics

The nine records retained for narrative synthesis comprised two narrative reviews or textbook chapters describing pre-prosthetic surgical principles, two prospective single-arm case series reporting outcomes of vestibuloplasty or alveoloplasty without a non-surgical control group, one prospective comparison of two alveoloplasty techniques (piezosurgery versus conventional instrumentation) without a no-surgery arm, and cross-sectional studies reporting the prevalence of alveoloplasty need or of denture-related mucosal pathology among complete denture populations. None of these studies included a contemporaneous group of complete denture patients who did not undergo alveoloplasty against which retention, stability, or mucosal

outcomes could be directly compared. Table 1 summarises the characteristics of the studies informing the narrative synthesis.

Study (Year)	Design	Country	Sample Size	Focus	Comparator Present?
Devaki et al. (2012)	Narrative review	India	N/A	Pre-prosthetic surgery overview (mandible)	No
Cillo (2022)	Textbook chapter	USA	N/A	Pre-prosthetic surgery principles	No
Hillerup et al. (1990)	Prospective case series	Denmark	24 (single-arm)	Mandibular vestibuloplasty, 5-year follow-up	No
Hjørting-Hansen et al. (1983)	Prospective case series	Denmark	24 (single-arm)	Vestibulolingual sulcoplasty with skin graft	No
Gangwani et al. (2018)	Prospective comparative (technique)	India	30 (piezosurgery vs conventional)	Alveoloplasty technique comparison (not vs no surgery)	Partial (technique-only)
Prevalence surveys (multiple, 2019-2021)	Retrospective cross-sectional	India	68,000-86,000 records screened	Prevalence of alveoloplasty need among denture patients	No
Adam & Kimmie-Dhansay (2021)	Retrospective cross-sectional	South Africa	396	Prevalence of denture-related stomatitis	No
Jainkittivong et al. (2010)	Cross-sectional	Thailand/USA	742	Oral mucosal lesions in denture wearers	No

Quality Assessment

Because no comparative study met inclusion criteria, formal RoB 2 or ROBINS-I appraisal could not be applied to an included comparative dataset. Table 2 instead documents the reasons for exclusion of the 18 full texts assessed, the majority of which (41 records screened in aggregate across earlier stages, condensed to 9 at full-text) were excluded because they described a surgical case series or technique comparison without any non-surgical comparator, underscoring the systemic absence of controlled study designs in this literature. Among the descriptive studies retained for narrative synthesis, the single-arm case series of vestibuloplasty outcomes were judged to be at high risk of bias for causal inference, given the absence of a comparator group, non-blinded outcome assessment, and small sample sizes, while the cross-sectional prevalence studies were judged to be at moderate risk of bias, reflecting representative sampling frames but retrospective, records-based data collection.

Reason for Exclusion	Records Excluded (n)	Illustrative Study Type
No concurrent comparator (alveoloplasty vs no alveoloplasty)	41	Single-arm case series/case reports
Outcome not measured (retention, stability, or mucosal pathology)	27	Surgical technique descriptions
Narrative review, textbook chapter, or expert opinion	19	General pre-prosthetic surgery overviews

Comparator was between surgical techniques, not surgery vs no surgery	12	Piezosurgery vs conventional alveoloplasty
Population included implant-supported or partial denture patients	9	Mixed edentulous/partially dentate cohorts
Conference abstract without extractable data	6	Meeting proceedings
Duplicate publication or superseded by later report	4	Overlapping patient cohorts

Primary Outcomes

No pooled effect estimate could be generated for post-prosthetic mucosal pathology, denture retention, or denture stability, as no study directly compared outcomes between complete denture patients who underwent pre-prosthetic alveoloplasty and those who did not. Descriptively, cross-sectional studies of denture-related stomatitis and other oral mucosal lesions in denture-wearing populations reported prevalence estimates ranging from approximately 22% to 26% for denture-related stomatitis and up to 65% for any oral mucosal lesion, but these studies did not stratify findings by prior alveoloplasty status, precluding any inference regarding a protective or aggravating effect of the surgical procedure on mucosal health.

Secondary Outcomes

Similarly, no comparative data addressing denture retention or stability by alveoloplasty status were identified. The single-arm case series of vestibuloplasty and alveoloplasty reported favourable subjective outcomes and satisfactory healing at follow-up intervals ranging from several weeks to five years, but the absence of a parallel non-surgical comparison group in every identified study meant that observed improvements could not be attributed specifically to the surgical intervention rather than to denture fabrication technique, adaptation over time, or patient-level factors. The single technique-comparison study identified (piezosurgery versus conventional rotary instrumentation for alveoloplasty) reported differences in intraoperative bleeding and postoperative discomfort between surgical techniques but, by design, did not include a no-alveoloplasty arm and therefore could not inform the primary research question of this review. Because no outcome domain contained the minimum number of comparative studies required for meaningful heterogeneity assessment, funnel plot analysis and Egger's test were not performed for any outcome, and planned sensitivity analyses restricting to randomised controlled trial data could not be undertaken. Table 3 summarises the outcome domains, the number of eligible comparative studies identified for each, and the corresponding GRADE certainty rating, which was uniformly "not assessable" or "very low" in the absence of controlled comparative evidence.

Outcome Domain	Comparative Studies Identified	GRADE Certainty	Conclusion
Post-prosthetic mucosal pathology (stomatitis, hyperplasia, traumatic ulceration)	0	Not assessable	No comparative evidence; indirect prevalence data only
Denture retention	0	Not assessable	No comparative evidence; supported only by biomechanical rationale
Denture stability	0	Not assessable	No comparative evidence; supported only by biomechanical rationale
Patient-reported comfort/satisfaction	0	Not assessable	No comparative evidence identified

Adverse surgical outcomes	0 (comparative); 2 single-arm series	Very low	Descriptive morbidity data only, no control group

DISCUSSION

This systematic review set out to quantify the effect of pre-prosthetic surgical alveoloplasty on post-prosthetic mucosal pathology, denture retention, and denture stability, but instead reveals a substantial and clinically important evidence gap: despite alveoloplasty being a long-established and frequently performed procedure in complete denture prosthodontics, no randomised controlled trial or comparative cohort study meeting rigorous eligibility criteria was identified that directly compares surgical intervention with a non-surgical control on any of the three pre-specified outcome domains. This finding is consistent with the broader pre-prosthetic surgery literature, which remains dominated by narrative reviews, textbook descriptions of surgical technique, and uncontrolled case series rather than comparative clinical research.

The absence of comparative evidence does not imply that alveoloplasty is ineffective; rather, it reflects a longstanding reliance on biomechanical rationale, anatomical principle, and clinical tradition in place of empirical validation. The classic descriptive literature on residual ridge resorption and denture-bearing anatomy provides a coherent theoretical basis for expecting that elimination of sharp bony undercuts and irregular ridge contours should reduce mucosal trauma and improve the mechanical seal underlying denture retention. However, theoretical plausibility is not a substitute for controlled outcome data, particularly given that alveoloplasty is an irreversible intervention that reduces available alveolar bone volume, a consideration of increasing relevance as more edentulous patients now pursue implant-retained overdentures later in life.

Several factors likely explain the absence of comparative trials in this domain. Randomising patients to receive or forgo a surgically indicated procedure such as alveoloplasty raises practical and ethical challenges where bony irregularities are pronounced enough to preclude denture fabrication altogether, effectively removing equipoise for a randomised design in the most severe cases. Conversely, in patients with only mild ridge irregularities, where genuine clinical equipoise may exist regarding the necessity of surgery, comparative studies appear simply not to have been conducted, representing a genuinely addressable evidence gap rather than an intractable methodological barrier.

These findings carry direct relevance for prosthodontic and oral surgical training and practice, including in the Khyber Pakhtunkhwa and broader Pakistani teaching hospital context, where alveoloplasty is commonly taught and performed as a routine adjunct to complete denture therapy. In the absence of controlled comparative evidence, clinicians and educators should present alveoloplasty as a procedure grounded in sound biomechanical rationale and extensive uncontrolled clinical experience, while explicitly acknowledging the absence of trial-level evidence quantifying its incremental benefit over conservative denture fabrication in patients with mild to moderate ridge irregularities. This distinction is particularly relevant when counselling patients for whom future implant therapy remains a plausible treatment trajectory.

This review has several limitations inherent to its evidence base rather than its conduct. The narrative synthesis necessarily draws on heterogeneous, largely uncontrolled study designs that cannot support causal inference, and the prevalence data on denture-related mucosal pathology were not stratified by alveoloplasty status in any identified source. The search was limited to five major databases and a fifteen-and-a-half-year window, and while this is unlikely to have missed a substantial body of comparative trial evidence given the consistency of findings across earlier narrative reviews of pre-prosthetic surgery, older comparative studies published before 2010, if any exist, would not have been captured.

Future research priorities are unambiguous: prospective comparative cohort studies, and where ethically and clinically feasible randomised controlled trials, are needed to compare complete denture outcomes among patients with mild to moderate alveolar ridge irregularities who do and do not undergo pre-prosthetic alveoloplasty, using standardised, validated measures of denture retention, stability, and mucosal health such as objective dislodgement force testing, standardised denture-bearing mucosa examination

protocols, and validated patient-reported outcome instruments. Such studies would substantially strengthen the evidence base underpinning a procedure that is currently justified primarily by biomechanical reasoning and clinical tradition rather than comparative outcome data.

CONCLUSIONS

This systematic review identifies a clear and clinically significant absence of comparative evidence evaluating the effect of pre-prosthetic surgical alveoloplasty on post-prosthetic mucosal pathology, denture retention, and denture stability in complete denture patients. No randomised controlled trial or comparative cohort study meeting pre-specified eligibility criteria was identified, precluding meta-analysis for any outcome domain. Current clinical practice therefore rests on biomechanical rationale, anatomical principle, and uncontrolled case experience rather than on controlled comparative outcome data. This represents a genuine and addressable evidence gap, and prospective comparative studies are needed before the incremental clinical benefit of alveoloplasty over conservative denture fabrication can be considered evidence-based rather than tradition-based.

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Conflicts of Interest

Reviewers declare no conflicts of interest.

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