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INPLASY

Socket-Shield Immediate Implant Placement in the Anterior Maxilla: A Systematic Review and Exploratory Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - No funding was received for this review..

Review stage at the time of initial registration - Preliminary searches.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025110081

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 25 November 2025 and was last updated on 14 November 2026.

INTRODUCTION

Review question / Objective The primary quantitative objective is to estimate the difference in the original seven-item Pink Esthetic Score (PES; range 0–14) between socket-shield and conventional immediate implant placement at 12 months after implant placement in maxillary incisor or canine sites. Six-month PES outcomes are examined separately.

Additional objectives are to describe facial bone and soft-tissue changes, patient-rated appearance or satisfaction, and reported complications. Within trials reporting anatomical and esthetic outcomes at the same visit, the review examines whether better tissue preservation is accompanied by better clinician-rated esthetics or patient-rated appearance. Comparisons with guided bone regeneration or vestibular socket therapy are considered separately from comparisons with conventional immediate implant placement.

Rationale Preservation of facial bone and peri-implant soft tissues is an important consideration in immediate implant placement in the anterior maxilla. The socket-shield technique aims to limit tissue remodeling by retaining a facial root fragment. Previous reviews have examined its anatomical and esthetic outcomes, including the influence of grafting protocols. However, differences in anatomical sites, comparator treatments, outcome measurements and follow-up intervals complicate interpretation of the available evidence.

This review focuses on maxillary incisor and canine sites and evaluates compatible original seven-item Pink Esthetic Scores at defined intervals after implant placement. It distinguishes conventional immediate implant placement from active tissue-preservation approaches, including guided bone regeneration and vestibular socket therapy. It also examines whether anatomical preservation is accompanied by better clinician-rated esthetics or patient-rated appearance within the same trial and assessment visit. This approach supports

interpretation of the clinical relevance of reported tissue changes while accounting for differences in treatment protocols, measurement methods and certainty of evidence.

Condition being studied Replacement of extracted maxillary incisors or canines with immediately placed dental implants, with particular attention to preservation of facial bone and peri-implant soft tissues, clinician-rated esthetics, patient-rated appearance or satisfaction, implant retention and treatment-related complications.

METHODS

Search strategy Searches were conducted on 6 November 2026 in PubMed through NCBI E-utilities and in Europe PMC through its REST search interface. Searches covered publications dated 1 January 1900 through 6 November 2026. No language or study-design filters were applied. Reference lists and regional journals were also checked.

PubMed main search

("socket shield"[tiab] OR "socket shields"[tiab] OR "root shield"[tiab] OR "partial extraction therapy"[tiab] OR "partial extraction therapies"[tiab] OR (("root membrane"[tiab] OR "root retention"[tiab] OR "root submergence"[tiab] OR "retained root fragment"[tiab] OR "retained root fragments"[tiab]) AND implant*[tiab])) AND ("1900/01/01"[dp] : "2026/11/06"[dp])

Additional PubMed search for variant terminology

((("shield technique"[tiab] OR "shielding technique"[tiab] OR "shield technology"[tiab] OR "shield method"[tiab] OR "shield techniques"[tiab] OR "shielding method"[tiab]) AND implant*[tiab] AND (dental[tiab] OR maxilla*[tiab] OR esthetic[tiab] OR aesthetic[tiab] OR socket*[tiab] OR incisor*[tiab] OR tooth[tiab] OR teeth[tiab])) AND ("1900/01/01"[dp] : "2026/11/06"[dp])) NOT (("socket shield"[tiab] OR "socket shields"[tiab] OR "root shield"[tiab] OR "partial extraction therapy"[tiab] OR "partial extraction therapies"[tiab] OR (("root membrane"[tiab] OR "root retention"[tiab] OR "root submergence"[tiab] OR "retained root fragment"[tiab] OR "retained root fragments"[tiab]) AND implant*[tiab])) AND ("1900/01/01"[dp] : "2026/11/06"[dp]))

Europe PMC search

(TITLE_ABS:"socket shield" OR TITLE_ABS:"socket shields" OR TITLE_ABS:"root shield" OR TITLE_ABS:"partial extraction therapy" OR TITLE_ABS:"partial extraction therapies" OR ((TITLE_ABS:"root membrane" OR TITLE_ABS:"root retention" OR TITLE_ABS:"root submergence" OR TITLE_ABS:"retained root fragment" OR TITLE_ABS:"retained root fragments") AND TITLE_ABS:implant*)) AND FIRST_PDATE:[1900-01-01 TO 2026-11-06]

The main PubMed query returned 245 records, the additional PubMed query returned 11 records, and Europe PMC returned 244 records. The exact searches and screening records are retained in Supplementary File S1.

Participant or population Patients undergoing immediate dental implant placement at maxillary incisor or canine sites. Reports involving mixed anatomical sites were eligible only when separate results for the relevant anterior maxillary sites could be identified.

Intervention Immediate dental implant placement using the socket-shield technique, in which a facial root fragment is retained during tooth extraction and implant placement. Associated graft or barrier use was recorded as reported in each trial.

Comparator The primary comparator was conventional immediate implant placement without retention of a socket shield. Comparisons with guided bone regeneration or vestibular socket therapy were considered separately because they represent active tissue-preservation strategies. Graft and barrier use in each treatment arm was recorded to distinguish the additional effect of root-fragment retention from differences between treatment protocols.

Study designs to be included Reports describing randomized controlled comparisons of socket-shield immediate implant placement with an eligible comparator at anterior maxillary sites. Nonrandomized studies, uncontrolled case series and case reports were outside the revised comparative eligibility criteria.

Eligibility criteria Clinical eligibility required a report describing a randomized comparison of immediate implant placement with a retained facial root fragment versus immediate placement without a shield at maxillary incisor or canine sites. Reports involving mixed anatomical sites required separately identifiable results for eligible sites. Conventional immediate placement, guided bone regeneration and vestibular socket therapy were eligible comparator approaches and were considered separately.

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Delayed implant placement, single-arm studies and comparisons between two socket-shield variants were excluded. Eligibility did not depend on the direction of the findings or the availability of numerical data suitable for meta-analysis. Searches applied no language restrictions and covered publications dated 1 January 1900 through 6 November 2026.

The current manuscript synthesizes the original 13 comparative reports. Three additional reports subsequently judged eligible are identified separately in Supplementary File S1. The restriction to the original report set is acknowledged as a limitation of completeness.

Information sources The searches documented for the current manuscript were conducted in PubMed and Europe PMC on 6 November 2026. Additional reports were sought through reference-list checks and regional journal searches. Search expressions, retrieved records, duplicate handling and screening decisions are retained in Supplementary File S1.

This information-sources entry is amended to reflect the searches actually documented for the present analysis.

Main outcome(s) The primary quantitative outcome was the final original seven-item Pink Esthetic Score (PES; range 0–14) at 12 months after implant placement. Higher scores indicate better clinician-rated peri-implant esthetics. The treatment effect was expressed as the mean difference between socket-shield and conventional immediate implant placement, calculated as socket-shield minus control.

Additional outcome(s) Additional outcomes included original seven-item Pink Esthetic Score at six months after implant placement; facial bone thickness, height or resorption; total ridge width; peri-implant soft-tissue contour or margin changes; patient-rated appearance and overall satisfaction; implant survival or study-defined success; and reported complications.

Anatomical outcomes were distinguished by tissue, measurement method and anatomical landmark. Patient-rated appearance and overall satisfaction were treated as separate outcomes. Follow-up measured from implant placement was distinguished from follow-up measured from restoration. Outcomes measured on different scales or using different time origins were not combined indiscriminately.

Data management Records were deduplicated using PMID, DOI and normalized title. Database screening used rule-based classification of titles and abstracts, with OpenAI ChatGPT assistance for screening and source checks. The retained records contain final screening decisions and extracted values but do not contain separate screening or extraction decisions for individual reviewers.

For each report, the extracted information included anatomical sites, numbers of patients and implants, comparator, graft or barrier use, measurement landmarks, outcome scale and the origin of follow-up. Facial plate thickness, total ridge width, interproximal marginal bone level and soft-tissue contour were treated as distinct measurements. Patient-rated appearance and overall satisfaction were extracted separately.

Numerical sources were recorded. For Zhang et al., the primary report established the PES scale and follow-up timing, while numerical group means and standard deviations were extracted from Figure 6 of Lu et al. A sensitivity analysis restricted to numerical values verified directly from primary trial tables was also performed.

Two reports with potentially overlapping cohorts were retained as separate reports, and their participants were not combined. Eligibility checks used available reports, abstracts and citation records. Separate counts of full texts sought and full texts not retrieved were not recorded. Supplementary File S1 contains the search records, selection decisions, extracted values, numerical sources and analysis code.

Quality assessment / Risk of bias analysis Risk of bias was assessed using the RoB 2 domains for the Pink Esthetic Score outcomes in the four reports contributing to the main or sensitivity analyses. Certainty of evidence was assessed separately for the six-month and 12-month pooled Pink Esthetic Score estimates using the GRADE domains of risk of bias, inconsistency, indirectness, imprecision and publication bias.

The outcome-level judgments and their rationale are reported in Supplementary File S1. Funnel plots and statistical tests for small-study effects were not performed because each main analysis contained only two trials.

Strategy of data synthesis The current synthesis comprises the original 13 comparative reports. The primary quantitative analysis compared final scores on the original seven-item Pink Esthetic Score at

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12 months after implant placement. Six-month scores were analyzed separately.

Each analysis required an independent randomized comparison of socket-shield treatment with conventional immediate implant placement and a mean, standard deviation and sample size for each arm. Mean differences were calculated as socket-shield minus control. Confidence intervals for individual trial estimates were calculated using the normal approximation.

Inverse-variance random-effects models used restricted maximum likelihood to estimate between-trial variance. Pooled 95% confidence intervals used the modified Knapp–Hartung method, with a minimum variance-scaling factor of one and a t distribution with k – 1 degrees of freedom, where k is the number of trials. Heterogeneity was described using I^2. Each trial contributed once per assessment time point.

Comparisons with guided bone regeneration or vestibular socket therapy were summarized separately. Anatomical outcomes, patient-reported outcomes and complications were described according to their measurement methods and follow-up definitions.

For trials reporting anatomy and esthetics at the same visit, the direction of the between-group differences was compared. In one trial, Welch confidence intervals were calculated for differences in facial plate loss, clinician-rated esthetics and patient-rated appearance at 12 months after restoration. These comparisons used group summaries; patient-level correlations were not estimated.

Subgroup analysis No formal subgroup interaction analysis or meta-regression was performed. Six-month and 12-month outcomes were analyzed in separate syntheses. Comparisons with guided bone regeneration and vestibular socket therapy were described separately from conventional immediate implant placement. Differences in graft use, tissue phenotype, anatomical measurement and follow-up were considered descriptively.

Sensitivity analysis Exploratory sensitivity analyses examined the 12-month result using a common-effect model, added a 12-month report with an unspecified Pink Esthetic Score scale maximum, and restricted the 12-month analysis to group values verified directly from primary trial tables.

The six-month analysis was also repeated after removing the report judged at high risk of bias. When only one trial remained, its individual estimate was reported.

These sensitivity analyses were developed after examination of the included reports and were not specified in the original registered protocol.

Language restriction English.

Country(ies) involved Saudi Arabia and Spain.

Keywords Socket-shield technique; immediate dental implants; anterior maxilla; dental biomaterials; alveolar bone preservation; guided bone regeneration; Pink Esthetic Score; patient satisfaction.

Other relevant information Amendment prepared on 14 November 2026 for INPLASY2025110081, originally registered on 25 November 2025.

This amendment records the development of the registered review and aligns the record with the methods documented in the current manuscript. Searches, screening, extraction and the analyses described in that manuscript had been completed when this amendment was prepared, and the study findings were known.

The title and author information have been updated to reflect the current manuscript. Eligibility has been narrowed to randomized comparisons at maxillary incisor or canine sites, corresponding to the revised focus on comparative treatment effects in the anterior maxilla. Search sources and publication-date coverage have been updated to reflect the documented searches.

The primary quantitative focus has changed from implant success and complications to the original seven-item Pink Esthetic Score at 12 months after implant placement. Six-month scores are analyzed separately, while implant retention, study-defined success and complications are described alongside other clinical outcomes. The revised synthesis distinguishes outcome scales, follow-up origins and comparator procedures to improve interpretability.

The specific pooling rules and sensitivity analyses were developed after examination of the reports. The risk-of-bias and certainty-assessment entries have been updated to describe the assessments actually performed. The unrelated wording about bruxism management in the original data-synthesis

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section is corrected by the socket-shield-specific synthesis methods supplied in this amendment.

The current synthesis remains limited to the original 13 comparative reports. Three additional reports were subsequently judged eligible and are identified separately in Supplementary File S1. They were not incorporated into the current 13-report synthesis, and none supplied an additional verified estimate meeting the criteria for either main Pink Esthetic Score analysis. This restriction limits completeness of the broader clinical synthesis.

This amendment records these changes after analysis and preserves the original registration date. It does not represent the revised analytical specifications as having been prespecified in the original protocol.

Dissemination plans The review is being prepared for submission to Applied Sciences. The search and study-selection records, extracted aggregate data, risk-of-bias and certainty assessments, numerical inputs and analysis code accompany the manuscript as supplementary material. The final publication will cite the INPLASY registration and describe the methodological amendments.

Contributions of each author

Author 1 — Abdullah Alqarni
Manuscript revision and editing, and software.
Author 2 — Hassan Ahmed Assiri
Conceptualisation and writing of the original draft.
Author 3 — Jose Rolando Merino López
Formal analysis and project administration.
Author 4 — Elham Alqassim
Manuscript revision and editing.
Author 5 — Sonia Egido-Moreno
Data curation and methodology.
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