INPLASY

Auto transplantation of mature teeth: A Meta-Analysis of the Impact of root canal treatment timing on outcomes with subgroup analysis by age and tooth

INPLASY2025120084

doi: 10.37766/inplasy2025.12.0084

Received: 24 December 2025

Published: 24 December 2025

Wang, RS; Wu, ZF.

Corresponding author:
ZHIFANG WU

vivianwrs@163.com

Author Affiliation:
School of Stomatology, Capital Medical University, Beijing 100050, China.

ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Data analysis.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025120084

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 24 December 2025 and was last updated on 24 December 2025.

INTRODUCTION

Review question / Objective Does the timing of root canal treatment (RCT) influence the success rate, survival rate, and complication rates after autologous tooth transplantation (ATT) of permanent teeth, and are outcomes associated with specific variables such as tooth position and patient age?

Condition being studied Autologous tooth transplantation is a biologically compatible restorative option with distinct clinical value. Although many observational studies and some systematic reviews have examined overall outcomes and prognostic factors of ATT, important limitations remain. A common issue is the mixing of teeth at different stages of root development (immature vs mature), despite fundamental differences in pulpal healing potential and complication profiles; pooling these populations may obscure problems unique to mature permanent teeth. In addition, existing reviews often focus on comparisons between transplantation and non-transplantation, or discuss RCT in a broad manner, rather than providing a focused synthesis for mature permanent teeth and a direct comparison across three pulp-management strategies (immediate RCT, delayed RCT, and no RCT/observation) for key outcomes. This evidence gap means clinical decisions are frequently guided by experience or institutional routines rather than higher-level evidence.

METHODS

Search strategy Two independent reviewers will perform electronic and manual searches for studies published from 1 January 1990 to 31 October 2025 in PubMed, Web of Science MEDLINE, EBSCOhost MEDLINE, and Ovid MEDLINE. Database filtering functions will be used to screen all studies related to autologous tooth transplantation to enhance search completeness. Reference lists of relevant studies will also be hand-searched.A MeSH-based strategy will be used. The planned search terms include:

("Transplantation, Autologous"[Mesh] OR autografting OR autologous transplantation* OR tooth transplantation) AND (root canal therap*[MeSH Terms] OR endodontic treatment OR root canal treatment) AND (immediately OR delayed OR deferred OR observation) AND (success rate OR survival rate OR root resorption OR ankylosis[MeSH Terms] OR pulp necrosis[MeSH Terms] OR infection OR bone adhesion).

Participant or population Patients receiving ATT of mature permanent teeth with completed root development.

Intervention Three strategies will be evaluated: Immediate root canal treatment(preoperative/ extra oral root canal treatment), Delayed root canal treatment (after surgery >=2weeks) ,No root canal treatment / observation.

Comparator Any pairwise comparison among the above strategies. For outcomes without direct comparative studies, pooled single-arm proportions will be synthesized as supportive evidence.

Study designs to be included Prospective and retrospective studies.

Eligibility criteria This review assessed the eligibility criteria of the included studies.

Inclusion criteria:

Human studies investigating autologous tooth transplantation (ATT) of mature permanent teeth.

Studies reporting at least one of the following outcomes for at least one pulp-management strategy: success rate, survival rate, or incidence of ankylosis (bone adhesion).

Follow-up duration ≥ 6 months.

Prospective or retrospective studies.

Published in English.

Exclusion criteria:

Studies that did not report success rate or survival rate.

Studies involving primary teeth or immature permanent teeth.

Animal studies or in vitro experiments.

Case reports, case series, expert opinions, and review articles.

Published in languages other than English.

Information sources The databases listed above(PubMed, Web of Science MEDLINE, EBSCOhost MEDLINE, and Ovid MEDLINE) will be searched. If key information is missing, the corresponding authors will be contacted when possible.

Main outcome(s) Success rate and survival rate of transplanted teeth. A transplanted tooth will be considered successful if it shows physiological mobility, no percussion pain, no signs of inflammation, probing depth ≤3 mm, and radiographic evidence of healthy alveolar bone with a normal periodontal ligament space, without progressive root resorption or ankylosis . Survival will be calculated based on the number of transplanted teeth remaining in the dental arch without indications for extraction.

Additional outcome(s) Incidence rate of ankylosis.

Data management Retrieved records will be imported into EndNote 21 and duplicates will be removed.

Quality assessment / Risk of bias analysis Risk of bias will be assessed using ROBINS-I, as recommended by the Cochrane Handbook for non-randomized studies of interventions. Two reviewers will independently evaluate seven domains: bias due to confounding, selection of participants, classification of interventions, deviations from intended interventions, missing data, measurement of outcomes (blinding), and selection of the reported result. Disagreements will be resolved through discussion.

Strategy of data synthesis Analyses will be conducted in RStudio. For pooled single-arm proportions, the metaprop() function (meta package) will be used: proportions will be combined on the logit scale, with Clopper–Pearson exact 95% confidence intervals for individual studies. A random-effects model will be applied, between-study variance (τ^2) will be estimated using maximum likelihood (ML), and pooled effects will be back-transformed to proportions.

For direct comparative meta-analyses of dichotomous outcomes, effects will be expressed as odds ratios (ORs) with 95% confidence intervals and presented in forest plots. Heterogeneity will be assessed using Cochran's Q test (df = N–1; α = 0.05) and quantified using I^2, with thresholds of 50% indicating low, moderate, and high heterogeneity, respectively. Random-effects models will be prioritized, and fixed-effect models will be used for sensitivity analyses.

Subgroup analysis Subgroup analyses will be conducted by patient age and tooth position to explore potential sources of heterogeneity and to evaluate whether these variables modify

outcomes. Statistical significance will be set at $P < 0.05$.

Sensitivity analysis If substantial heterogeneity is present, leave-one-out sensitivity analyses will be performed by excluding studies one at a time to assess the stability of pooled estimates and identify influential studies.

Language restriction English.

Country(ies) involved China.

Keywords Autologous tooth transplantation (ATT), Root canal treatment (RCT), Success rate, Survival rate,Incidence rate of ankylosis, Meta analysis.

Contributions of each author

Author 1 - RUOSHUI WANG.
Email: vivianwrs@163.com
Author 2 - ZHIFANG WU.