

Supplementary Table S1 Statistical analysis steps

Statistical steps

I. Data preparation and outcome^a coding

- Define each treated primary molar as the unit of analysis.
- Calculate follow-up time from the date of treatment completion to failure and censored observations.
- Define failure as the event of interest.
- Code candidate predictors of interest, including tooth-level, preoperative disease-burden, and treatment-level variables, according to the predefined categories used in the analysis.
- Code failure and censored observations for the primary KM and Cox analyses
- Label non-failure extractions as competing events for the Fine–Gray sensitivity analysis.

II. Descriptive analysis

- Summarise categorical variables as frequencies and percentages.
- Summarise follow-up duration as median and IQR.
- Report the distribution of failure events, censored observations, competing events, and censoring reasons.

III. Primary survival analysis

- Estimate tooth survival and survival estimates using the KM estimator.
- Identify number at risk over the 5-year observation period.
- Calculate restricted mean survival time using a truncation time of 48 months because the number of teeth remaining at risk was limited beyond this time point.
- Calculate restricted mean time lost as the difference between 48 months and the 48-month RMST.

IV. Screen candidate predictors using univariate Cox regression

- Assess each candidate predictor using univariate Cox proportional hazards regression.
- Select variables with a univariate p -value <0.10 for consideration in the final multivariable model.
- Assess associations among categorical candidate predictors using Pearson chi-square tests, and review candidate predictors for clinical overlap, sparse categories, biological plausibility, and potential overlap before multivariable Cox modelling.

V. Final multivariable Cox regression model

- Reduce potential overfitting by limiting the number of model parameters^b by
 - Analyse child age at treatment as a quantitative (continuous) variable events-per-parameter ratio of approximately 9.4 (47 failure events/5 parameters).
- Account for within-child clustering by applying robust cluster variance estimation using the Huber–White sandwich estimator.
- Report associations as HRs with 95% CI.

VI. Model robustness and proportional hazards diagnostics

- Assess the stability and uncertainty of the primary HRs using bootstrap CIs for the final Cox model using 242 patient-level clusters and 326 tooth-level observations.
- Assess whether the HRs estimated by the final multivariable Cox model could be interpreted as approximately constant relative hazards over follow-up time.
 - Use Schoenfeld residual-based tests to assess variable-specific and global evidence of proportional hazards violation.
 - Inspect log-minus-log survival plots for categorical predictors.

VII. Sensitivity analysis accounting for competing events and potential informative censoring

- Examine the influence of documented competing events^c and potential informative censoring^d using an IPCW-adjusted Fine–Gray subdistribution hazards model.
- Report associations from the model as sHRs with 95% CI.
- Compare IPCW-adjusted Fine–Gray results with the primary multivariable Cox model results.
- Compare the unweighted KM estimate plotted as cumulative incidence with the IPCW-adjusted Fine–Gray cumulative incidence function.

Statistical significance Set statistical significance at $p < 0.05$ for all analyses.

Abbreviation: CI, confidence interval; HR, hazard ratio; IPCW, inverse probability of censoring weighting; IQR, interquartile range; KM, Kaplan–Meier; RMST, restricted mean survival time; RMTL, restricted mean time lost; sHR, subdistribution hazard ratio.

^a Definitions of the failure event, censored observations, competing events, and follow-up time are described in the Outcome assessment subsection.

^b Model parameters refer to one continuous parameter for child age at treatment, two indicator parameters for preoperative soft-tissue appearance, and two indicator parameters for preoperative root resorption.

^c Documented competing events were defined as documented non-failure extractions that precluded subsequent observation of pulpectomy failure, including extractions for orthodontic reasons and extractions associated with exfoliation-related pain.

^d Potential informative censoring refers to the possibility that teeth with loss to follow-up or unknown outcome status may have had a different underlying risk of failure from teeth that remained under observation.