

ABSTRACT

Purpose: To compare dental procedure failure rates in pediatric patients based on general anesthesia (GA), cooperative/positive conscious sedation (pCS), and uncooperative/negative conscious sedation (nCS).

Methods: A retrospective review analyzed dental treatments under GA or CS. Of 1,758 charts reviewed, 621 met inclusion criteria, covering 4,322 procedures. Patients were ≤8 years old, ASA I or II, with 24–48 months of clinical and radiographic follow-up. Data collected included procedure date, ASA status, pharmacological/ behavior group, tooth site, procedure type, time to failure, and failure reason. Descriptive statistics and chi-square tests were performed (p<.05 considered significant).

Results: Stainless steel crowns showed no significant failure rate differences by sedation type (p=.805) but failed significantly due to external root resorption (p=.004). Amalgam and resin class I and V restorations failed more under nCS (p=.0009, p=.0001), with recurrent decay as the primary failure reason. Pulpotomy failure was significantly higher with nCS (p=.001). Anterior restorations failed more than posterior ones (p=.0014), while maxillary-mandibular position was not significant. ASA classification alone did not impact failure rates (p=.95).

Conclusion: Sedation type influences restoration failure rates, with uncooperative CS linked to higher failures in amalgam, resin, and pulp therapies. Anterior restorations failed more frequently, regardless of sedation type. Stainless steel crowns demonstrated consistent success, independent of cooperation and/or pharmacological adjunct, reinforcing their role in high-risk pediatric care.

BACKGROUND

Background

- Dental caries is the most common childhood disease, occurring 4–5 times more frequently than asthma (Heng, 2016).
- The AAPD emphasizes caries management through risk assessment, understanding disease progression, and monitoring outcomes (AAPD, 2024).

Restorative Success Rates

- Stainless steel crowns (SSCs) are highly effective, outperforming composite and amalgam, particularly for high-risk patients (AAPD, 2024).
- Sheller et al. (2003) reported SSCs had a 93% success rate in GA retreatment cases, versus 27% for composite/amalgam.
- Composite restorations require strict isolation, with failure risks from polymerization shrinkage and moisture contamination (Donly and Garcia-Godooy, 2002). Amalgam is less technique-sensitive (Fuks, 2002).

Sedation and Success Rates

- Prior studies show lower failure rates for restorations placed under general anesthesia (GA) versus conscious sedation (CS) (Gandhi, 2017; Eidelman, 2000; Blumer, 2019). All concluded GA having the best success rates.
- This study compares restoration failure rates between GA and CS, assessing how patient cooperation affects CS outcomes.
- Findings will guide clinicians in treatment planning and parental decision-making regarding sedation options.

We hypothesize that the success rate of dental restorations depend on many variables, including procedure type, tooth number/location, and patient behavior.

METHODS

Study Approval & Scope: Approved by UT Health Houston (HSC-DB-24-0426), reviewing EHRs (Axium) from July 1, 2011 – June 12, 2024. Focused on pediatric patients (≤8 years) treated under GA or CS by dental residents with a 24-48 month follow-up.

Inclusion Criteria: ASA I-II, treatment under GA or CS completed by residents under supervision, documented behavior rating.

Exclusion Criteria: ASA III-IV, > age 8, failures beyond 48 months.

Data Collected: Date, ASA status, behavior rating (GA, pCS, nCS), procedure type, failure time/reason (abscess, external or internal root resorption, recurrent decay, furcation involvement, periapical involvement, fractured or lost restoration, open margin, perforated or ill-fitting restoration, symptomatic presentation, or loss of facial resin from the crown.

Behavior Scoring: GA (all GA patients), pCS (Frankl 3-4), nCS (Frankl 1-2). Missing scores were double-blind interpreted.

Analysis: Descriptive stats, chi-square, Fisher tests (p<.05 significant).

RESULTS

Study Population: 621 patients met inclusion criteria; 287 had multiple sedation/GA appointments.

Procedures & Groups: 175 GA, 587 pCS, 256 nCS appointments; 1,678 GA, 1,940 pCS, 702 nCS procedures.

Stainless Steel Crowns (SSC): 1,041 GA, 1,065 pCS, 340 nCS; no significant failure rate difference (p=.805; 3, 3, 3). Pre-veneered SSCs (385 total) also showed no significance (p=.184; 6, 8, 13).

Failure Causes: SSC failures in nCS were root-related (p=.03); GA/pCS failures mostly due to restoration loss, though not significant (p=.26)

Amalgam & Resin Restorations: Class I/V restorations significantly affected by pharmacologic group (p<0.001; amalgam: 12, 11, 35, composite: 8, 21, 33), with nCS having highest failure rates. Recurrent decay was significant failure reason for class I, II, and V amalgam and composite restorations.

Pulp Therapies: Vital pulpotomies significantly impacted by pharmacologic group (p=.001; 7, 20, 25), with nCS having highest failure rates.

Location Influence: Anterior restorations failed more than posterior regardless of pharm group (p=0.001358); no significant difference for maxillary vs. mandibular failures (p=.2866).

ASA Class: No significant difference (p=.9452).

TABLES

Table 1. Failure rate by procedure and pharmacologic behavior guidance technique.

| Treatment Rendered** | Pharmacologic Behavior Guidance Technique* | | | p-value |
|-----------------------|--|---------------------|---------------------|---------|
| | General Anesthesia | Frankl (+) Sedation | Frankl (-) Sedation | |
| SSC/rwSSC | 1041, 3.36 | 1065, 3.10 | 340, 2.65 | 0.8 |
| pvSSC | 183, 6.01 | 114, 7.89 | 88, 12.5 | 0.18 |
| FC Pulpotomy | 87, 8.05 | 101, 18.81 | 42, 26.19 | 0.019 |
| FS Pulpotomy | 53, 7.55 | 23, 26.09 | 18, 22.22 | 0.058 |
| Ag Class I, V | 50, 12 | 82, 10.98 | 55, 34.55 | <0.001 |
| Ag Class II | 8, 37.5 | 119, 23.53 | 24, 45.83 | 0.058 |
| Resin Class I, V | 108, 8.33 | 207, 21.26 | 92, 32.61 | <0.001 |
| Resin Class II | 11, 0 | 62, 25.81 | 10, 30 | 0.13 |
| Resin III, IV, SC | 36, 33.33 | 74, 13.51 | 16, 18.75 | 0.055 |
| Pulpectomy | 13, 7.69 | 17, 5.89 | 3, 33.33 | 0.31 |
| Zirconia | 35, 5.71 | 35, 5.71 | 5, 0 | 1 |
| FC, FS, MTA Pulpotomy | 149, 7.38 | 126, 19.84 | 60, 25 | 0.001 |

*In each column, first number represents total number of procedures, second number represents failure rate (percent).

**Procedures with less than 5 were excluded from analysis

Table 2. Failure rate by location and ASA classification, including pharmacologic behavior guidance technique.

| Variable | Pharmacologic Behavior Guidance Technique* | | | p-value |
|--------------|--|---------------------|---------------------|---------|
| | General Anesthesia | Frankl (+) Sedation | Frankl (-) Sedation | |
| Anterior | 619, 7.11 | 410, 10.73 | 185, 20.0 | 0.001 |
| Posterior | 1059, 4.44 | 1530, 8.89 | 517, 12.77 | |
| pBGT p-value | | <0.001 | | |
| Maxilla | 985, 6.09 | 1052, 9.03 | 411, 16.10 | 0.28 |
| Mandible | 693, 4.47 | 888, 9.57 | 291, 12.71 | |
| pBGT p-value | | <0.001 | | |
| ASA I | 738, 6.78 | 1226, 8.81 | 454, 13.88 | 0.95 |
| ASA II | 940, 4.36 | 714, 10.08 | 248, 16.13 | |
| pBGT p-value | | <0.001 | | |

Table 3. Failure reason by procedure type.

| Failure Reason | Procedure Type | Pharmacologic Behavior Guidance Technique* | | | p-value |
|--------------------------|-------------------------|--|---------------------|---------------------|---------|
| | | General Anesthesia | Frankl (+) Sedation | Frankl (-) Sedation | |
| External Root Resorption | SSC/rwSSC | 4, 11.43% | 0, 0% | 2, 22.22% | 0.03 |
| External Root Resorption | PVSSC | 0, 0% | 3, 33.33% | 5, 45.45% | 0.004 |
| Recurrent Decay | Ag class I, V | 6, 100% | 7, 77.78% | 16, 82.21% | 0.004 |
| Recurrent Decay | Ag class II | 3, 100% | 16, 57.14% | 9, 81.82% | 0.01 |
| Recurrent Decay | Resin class I, V | 5, 55.56% | 34, 77.27% | 24, 80.00% | <0.001 |
| Recurrent Decay | Resin class III, IV, SC | 9, 75% | 4, 40% | 2, 66.67% | 0.01 |

CONCLUSIONS

- Failure rate is affected by patient behavior and restoration type, with more failures in noncooperative sedations.
- Failure rate is affected by position in mouth (anterior vs. posterior).
- Practitioners should use this information during treatment planning to ensure longevity of restorations in the primary dentition.

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REFERENCES

