

## Introduction

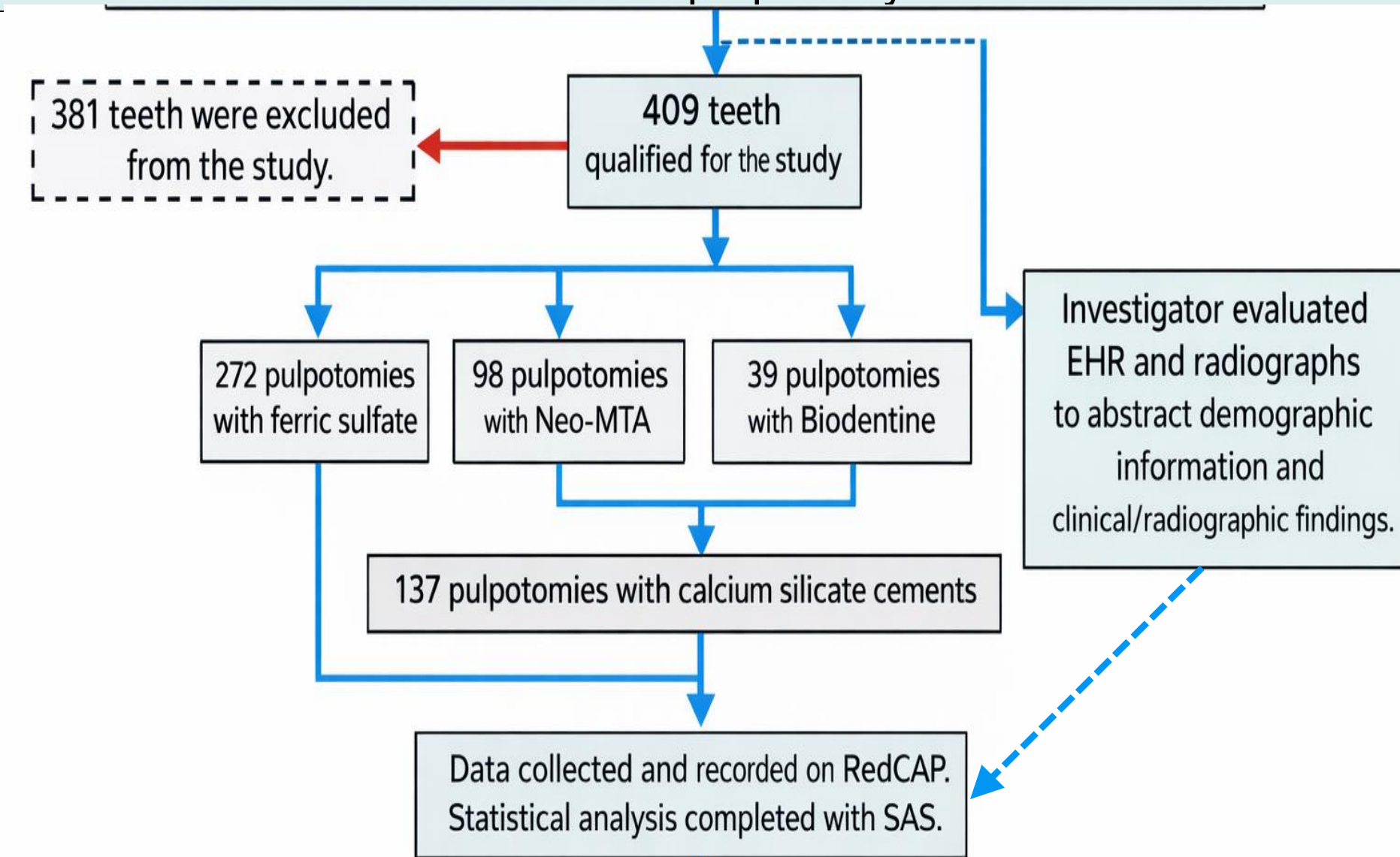
- Primary tooth pulpotomies using calcium silicate cements (CSC) are now becoming more standard practice in pediatric dentistry practices due to its high success rate shown in small sample size randomized controlled trials (RCT).<sup>2</sup>
- However, long term clinical follow up on primary teeth with CSC pulpotomies are limited, with most follow up being only up to 24 months. Larger retrospective studies that assess real-world clinical application of CSC, with consideration of causal inference, may be useful when building a greater knowledge base in comparison to RCT with a small number of teeth studied.<sup>1,2</sup>
- At Hennepin Healthcare, we can conduct a natural experiment in which we systematically changed our practice in 2018 from ferric sulfate (FS) pulpotomies to CSC pulpotomies to compare four-year success rates of the different pulpotomy medicaments.

## Purpose

The aim of this study is to determine if there are differences with overall clinical and radiographic success rates of pulpotomies using ferric sulfate or calcium silicate cements, including NeoMTA and Biodentine, completed at Hennepin Healthcare in the clinical and operating room setting.

## Methods

Pulpotomies identified using dental code D3220 on primary teeth completed between Jan 2015 to Dec 2021. Data was collected between June 2025 and October 2025 for the potential of four year follow up data. 563 subjects identified for a total of 790 teeth treated with pulpotomies. Failure of a pulpotomy has been defined as soft tissue pathology, pain, pathologic mobility, pathologic radiolucency, or pathologic root resorption<sup>2</sup> as well as exfoliation within 6 months of pulpotomy treatment.



## Results

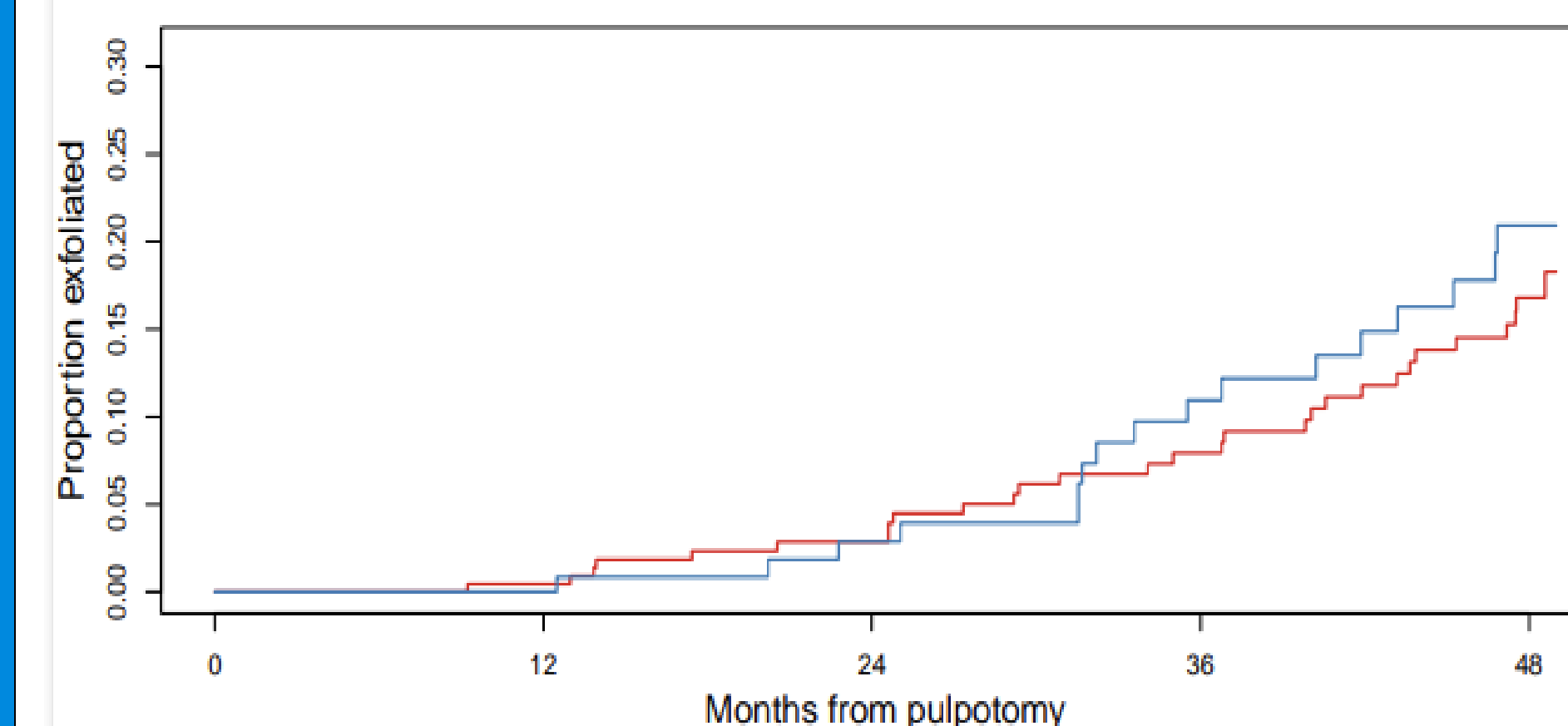
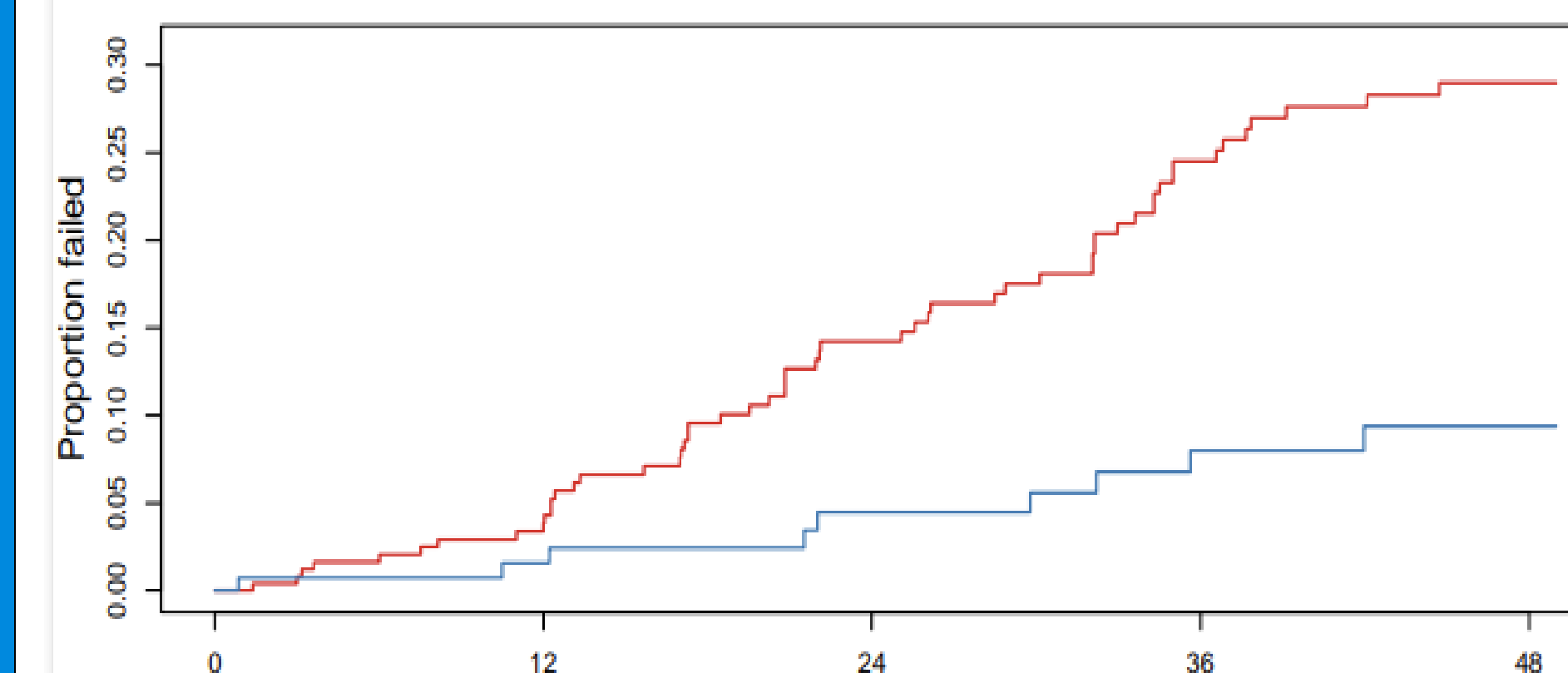
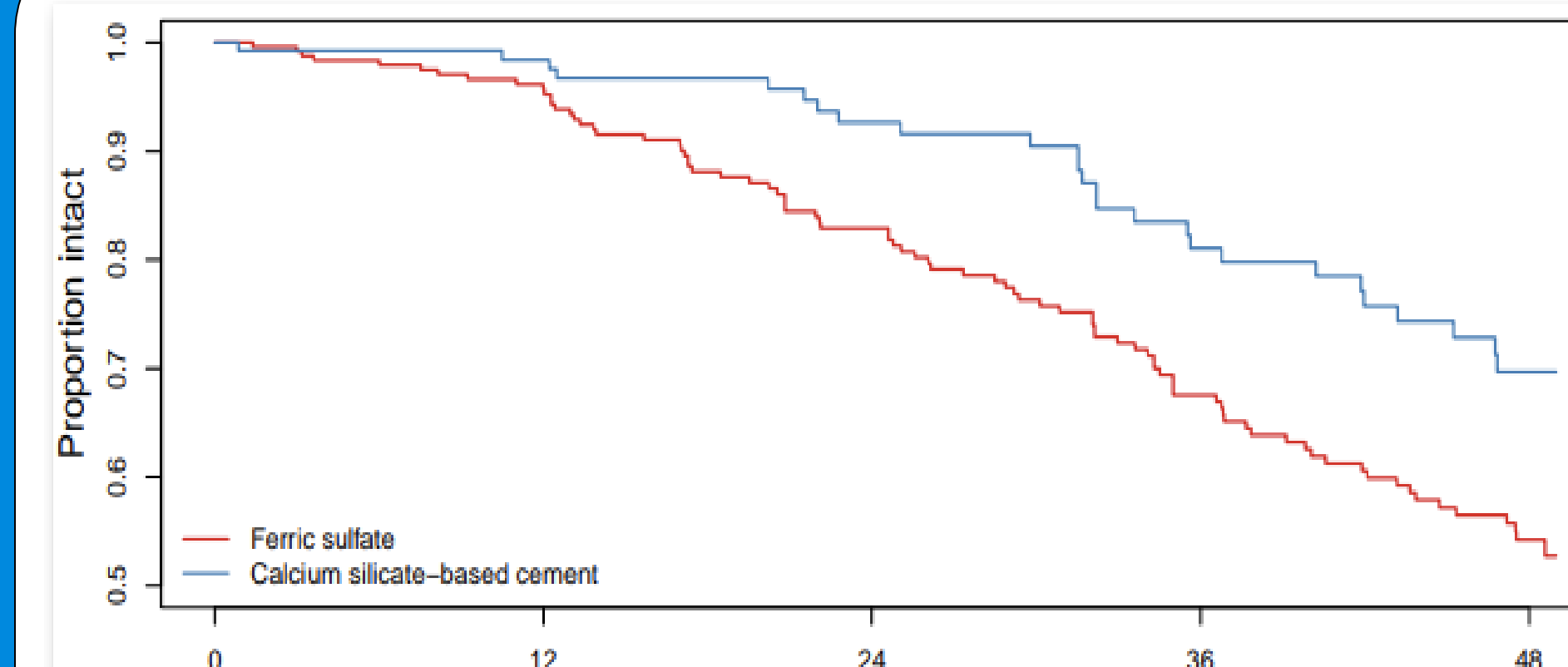
Table 1. Demographic data by patient based on material used for pulpotomy.

	Ferric sulfate	Calcium silicate cement	Total
<b>Patients</b>	167	95	262
<b>Average age (SD)</b>	5.3 (1.8)	5.1 (1.5)	p=0.57
<b>Female (%)</b>	69 (41.32)	45 (47.37)	p=0.34
<b>Male (%)</b>	98 (58.68)	50 (52.63)	
<b>Race/Ethnicity</b>			p=0.91
White (%)	9 (5.39)	4 (4.21)	
Black (%)	45 (26.95)	25 (26.32)	
Asian/Pacific Islander (%)	8 (4.79)	6 (6.32)	
Hispanic (%)	98 (58.68)	54 (56.84)	
Other/Unknown (%)	7 (4.19)	6 (6.32)	
<b>Treatment setting</b>			p=0.29
Dental Clinic (%)	43 (25.75)	19 (20)	
Operating room (%)	124 (74.25)	76 (80)	

Table 2. Demographic data by tooth based on material used for pulpotomy.

	Ferric sulfate	Calcium silicate cement	Total
<b>Teeth treated</b>	272	137	Total=409
<b>Primary tooth type</b>			p=0.33
Second molar (%)	107 (39.34)	64 (46.72)	
First molar (%)	160 (58.82)	70 (51.09)	
Anterior (%)	5 (1.84)	3 (2.19)	
<b>Depth of interproximal caries</b>			p=0.40
Deep (%)	133 (48.90)	61 (44.53)	
Extremely deep (%)	139 (51.10)	76 (55.47)	
<b>Pulpal diagnosis</b>			p < 0.001
Normal pulp (%)	199 (73.16)	101 (73.72)	
Reversible pulpitis (%)	69 (25.37)	21 (15.33)	
Irreversible pulpitis (%)	4 (1.47)	15 (10.95)	

Note: Other/Unknown for Race/Ethnicity include American Indian, Alaska Native, or Multiracial patients. Reversible pulpitis is defined as teeth with unspecified pain and pain to eating, hot, cold, and tooth brushing. Irreversible pulpitis is defined as teeth with spontaneous or nocturnal pain as well as percussion and/or palpation sensitivity.



	0	12	24	36	48
<b>Number of intact restorations (at risk)</b>	272	208	155	110	72
	137	116	87	66	43
<b>Number of failed restorations</b>	0	9	30	48	55
	0	2	5	8	9
<b>Number of exfoliated restorations</b>	0	1	6	15	28
	0	0	3	10	17

Figure 1. Kaplan-Meier curves depicting proportion intact, proportion failed, and proportion exfoliated, which was considered successful, of Ferric sulfate vs Calcium Silicate cements at annual intervals 12, 24, 36, and 48 months.

Table 3. Success rate of pulpotomies at timepoints 12, 24, 36 and 48 months based on material.

	FS	CS	Difference (95% CI)	NNT
<b>Overall success rate %</b>				
12 months	96.2	98.4	2.3 (-1.0, 5.6)	-
24 months	85.8	95.5	9.8 (3.6, 15.9)	10.2
36 months	75.5	92.0	16.5 (8.3, 24.7)	6.1
48 months	71.0	90.6	19.6 (10.7, 28.5)	5.1

## Discussion

- Hennepin Healthcare has a unique patient population, including a high percentage of Hispanic and Medicaid Insured patients.
- No significant difference between NeoMTA vs Biodentine pulpotomy success after 24 months<sup>3</sup>. Therefore, this study utilizes combined data.
- At 12 months, the success difference between FS and CSC is not statistically significant but becomes significant (p<0.005) beginning at 24 months and continuing through 48 months.
- When comparing CSC to FS pulpotomies, the NNT at 48 months was 5.1, which is notable for extending results from prior studies with 24-month outcomes.
- Adjusted results via propensity score weighting were similar to unadjusted data allowing for approximation of a RCT type study (results not shown).

## Conclusion

We have shown, with real-world data, the effectiveness of calcium silicate-based cements for primary teeth. Our findings contribute to an expanding knowledge base that CSC pulpotomies are more successful than FS pulpotomies, and CSC should be used in clinical practice, especially if the tooth is expected to be present for more than 12 months.

## References

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- Smail-Faugeron V, Fron Chabouis H, Durieux P, Attal J-P, Muller-Bolla M, Courson F. 2013. Development of a Core Set of Outcomes for Randomized Controlled Trials with Multiple Outcomes – Example of Pulp Treatments of Primary Teeth for Extensive Decay in Children. *PLoS ONE*; 8(1):e51908.
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