

Introduction

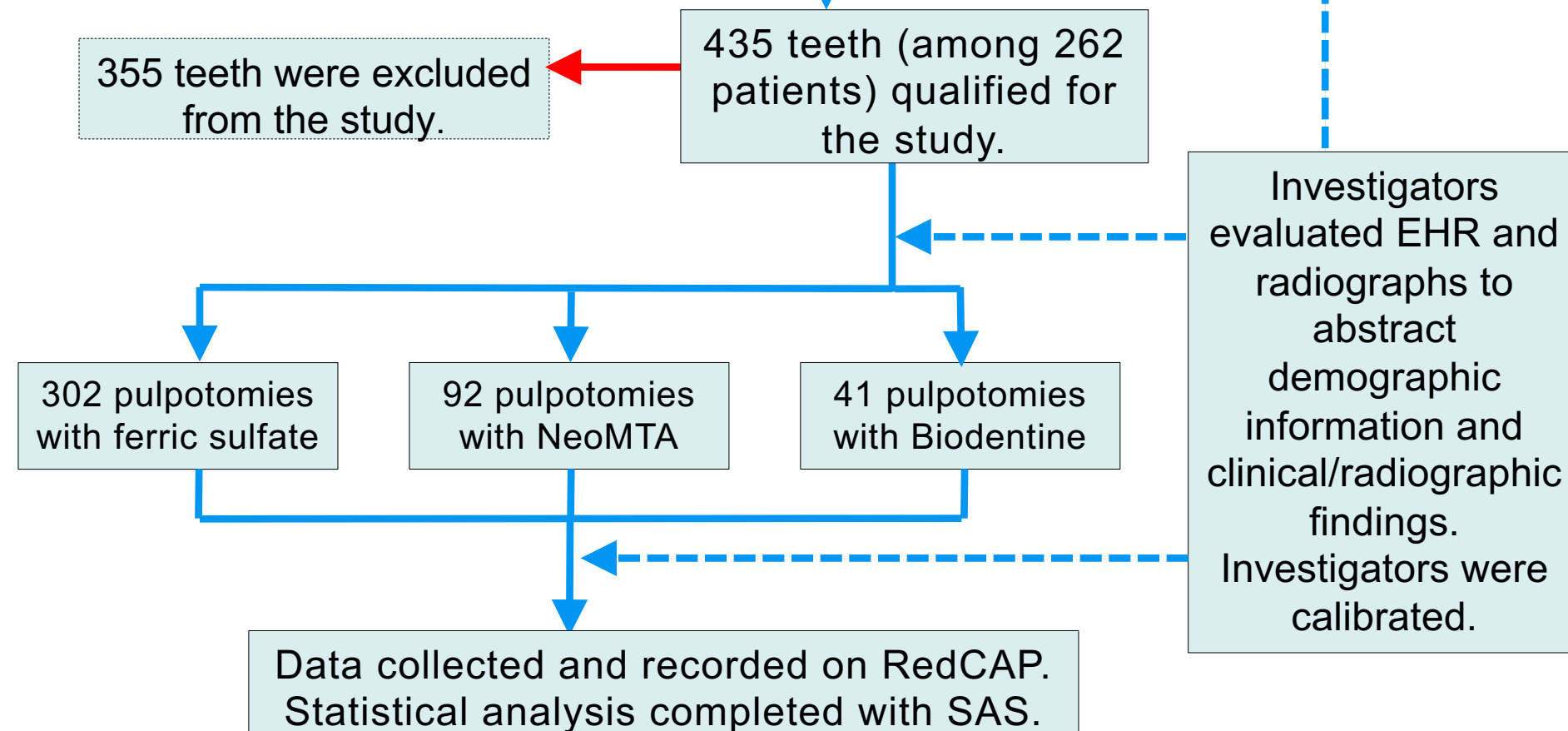
- Pulpotomies have been used for years as a treatment for vital primary teeth with caries into the pulp, though different medicaments have varying success rates.¹
- Past studies have compared the success rates of each medicament.^{2,3,4} Success is measured by overall longevity of the tooth and absence of any signs of pathology both clinically and radiographically.¹
- Three medicaments have been used at Hennepin Healthcare for pulpotomy procedures: ferric sulfate, NeoMTA (NuSmile NeoMTA 2), and Biodentine. On October 2018, a shift from using ferric sulfate to NeoMTA and Biodentine occurred.

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, NeoMTA, or Biodentine completed at Hennepin Healthcare.

Methods

Pulpotomies identified using dental code D3220 on primary teeth completed between Jan 2016 to Dec 2021. 563 subjects identified for a total of 790 teeth treated with pulpotomies.



- Note: Exclusion criteria:
- Patients without documented research authorization in EHR.
 - Teeth treated with medicaments other than Ferric sulfate, NeoMTA, or Biodentine.
 - Teeth that did not have a pulpotomy at HH.
 - Teeth that were diagnosed with necrosis.
 - Patients that are not patients of records at Hennepin Healthcare.

Results

| | Ferric sulfate | NeoMTA | Biodentine | Total=435 |
|--------------------------------------|----------------|-----------|------------|-----------|
| Teeth treated | 302 | 92 | 41 | |
| Average age (SD) | 5.2 (1.6) | 4.9 (1.5) | 5.1 (1.7) | p=0.31 |
| Female (%) | 139 (46) | 42 (46) | 19 (46) | p=0.99 |
| Male (%) | 163 (54) | 50 (54) | 22 (54) | |
| Race/Ethnicity | | | | p=0.64 |
| White (%) | 18 (6) | 4 (4) | 1 (2) | |
| Black (%) | 101 (33) | 25 (27) | 12 (29) | |
| Asian/Pacific Islander (%) | 14 (5) | 9 (10) | 1 (2) | |
| Hispanic (%) | 160 (53) | 51 (55) | 26 (63) | |
| Other/Unknown (%) | 9 (3) | 3 (3) | 1 (2) | |
| Primary tooth type | | | | p=0.22 |
| Second molar (%) | 120 (40) | 43 (47) | 23 (56) | |
| First molar (%) | 175 (58) | 46 (50) | 18 (44) | |
| Anterior (%) | 7 (2) | 3 (3) | 0 (0) | |
| Depth of interproximal caries | | | | p=0.24 |
| Shallow/moderate (%) | 148 (49) | 37 (40) | 22 (54) | |
| Deep/approximating pulp (%) | 154 (51) | 55 (60) | 19 (46) | |
| Treatment setting | | | | p=0.07 |
| Operating room (%) | 252 (83) | 82 (89) | 30 (73) | |
| Dental clinic (%) | 50 (17) | 10 (11) | 11 (27) | |
| Pulpal diagnosis | | | | p < 0.01 |
| Normal pulp (%) | 224 (74) | 76 (83) | 28 (69) | |
| Reversible pulpitis (%) | 75 (25) | 10 (11) | 3 (7) | |
| Irreversible pulpitis (%) | 3 (1) | 6 (7) | 10 (24) | |

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 pain or teeth that cause nocturnal pain.

Table 2. Success rate of pulpotomies at timepoints 12-48 months based on material.

| | Ferric sulfate | NeoMTA | Biodentine | |
|---|----------------|--------------|--------------|-----------|
| Overall success rate %, [95 % CI] | | | | p = 0.004 |
| 12 months | 96 [93, 98] | 99 [96, 100] | 98 [93, 100] | |
| 24 months | 87 [82, 91] | 94 [88, 100] | 98 [93, 100] | |
| 36 months | 76 [70, 83] | 94 [88, 100] | 98 [93, 100] | |
| 48 months | 72 [66, 80] | 82 [65, 100] | 98 [93, 100] | |
| Clinical success rate %, [95 % CI] | | | | p = 0.158 |
| 12 months | 97 [95, 99] | 99 [96, 100] | 98 [93, 100] | |
| 24 months | 91 [87, 95] | 94 [88, 100] | 98 [93, 100] | |
| 36 months | 84 [78, 90] | 94 [88, 100] | 98 [93, 100] | |
| 48 months | 81 [74, 88] | 82 [65, 100] | 98 [93, 100] | |
| Radiographic success rate %, [95 % CI] | | | | p = 0.021 |
| 12 months | 96 [93, 98] | 98 [94, 100] | 97 [90, 100] | |
| 24 months | 86 [81, 91] | 92 [84, 100] | 97 [90, 100] | |
| 36 months | 75 [69, 82] | 92 [84, 100] | 97 [90, 100] | |
| 48 months | 71 [64, 79] | 74 [47, 100] | 97 [90, 100] | |

Results cont.

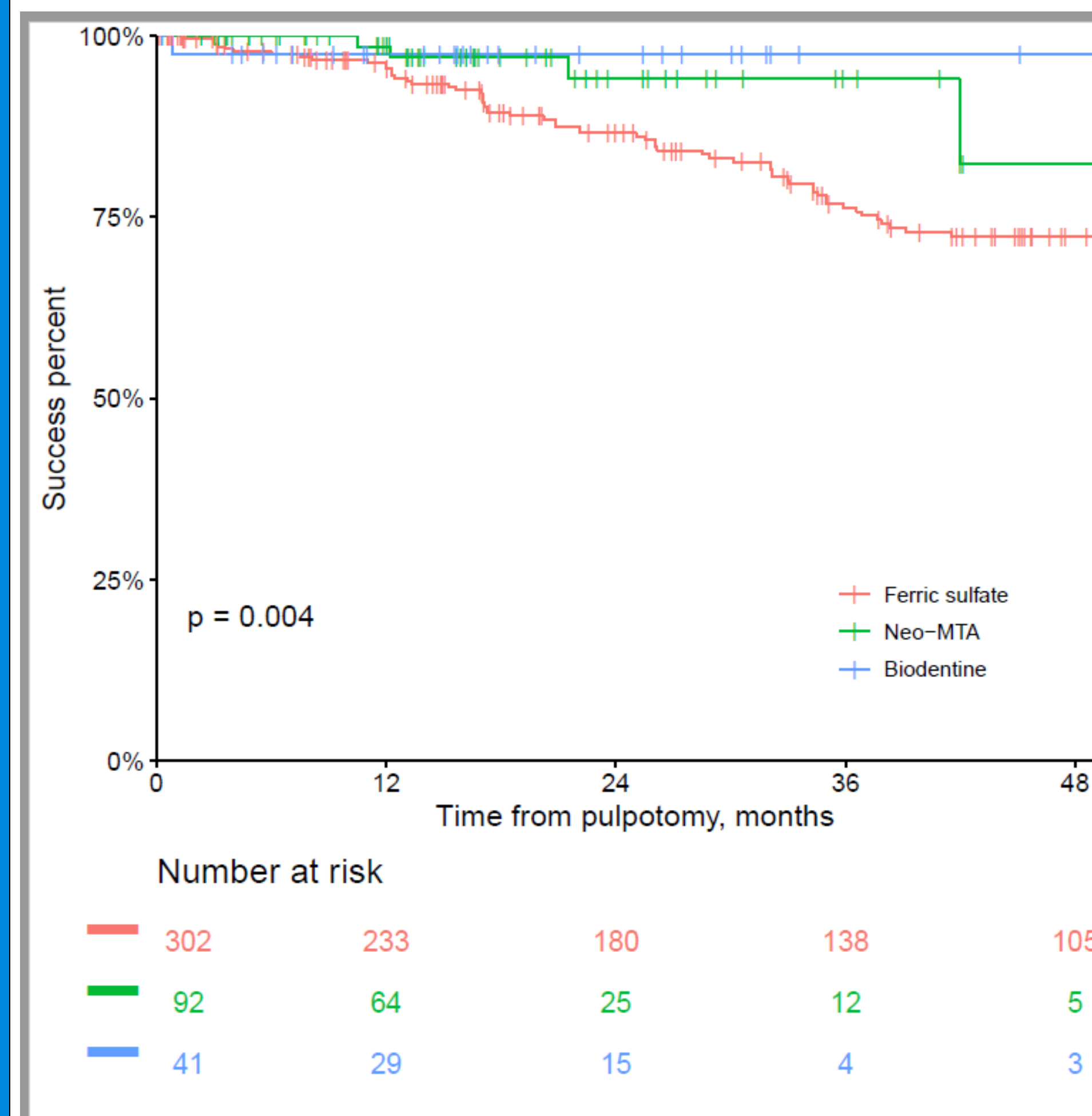


Figure 1. Kaplan-Meier curves depicting overall success of Ferric sulfate vs NeoMTA vs Biodentine. Overall success is a combination of both clinical or radiographic success. When all three materials are compared, there is a statistically significant difference between the survival curves (p = 0.004)

Table 3. Hazard ratios comparing NeoMTA or Biodentine to Ferric sulfate.

| | NeoMTA | Biodentine |
|---|-------------------|-------------------|
| Overall failure hazard ratio, [95 % CI] | 0.38 [0.14, 1.02] | 0.20 [0.03, 1.52] |
| NNT at 36 months | 7 | 5 |
| | p = 0.06 | p = 0.12 |
| Clinical failure hazard ratio, [95 % CI] | 0.61 [0.22, 1.67] | 0.31 [0.04, 2.41] |
| NNT at 36 months | 17 | 9 |
| | p = 0.34 | p = 0.27 |
| Radiographic failure hazard ratio, [95 % CI] | 0.48 [0.18, 1.28] | 0.22 [0.03, 1.70] |
| NNT at 36 months | 8 | 5 |
| | p = 0.14 | p = 0.15 |

Ferric sulfate used as reference in calculating hazard ratios. No significance between overall, clinical, or radiographic failure. Overall failure between Ferric sulfate and NeoMTA approaching significance.

Discussion

- Most of the patients who had pulpotomies at Hennepin Healthcare did not come back for clinical or radiographic follow up. Of the 790 primary teeth treated, only 435 had clinical follow up and only 325 teeth had post-treatment radiographs.
- Strong predilection for pulpotomies treated in an operating room setting may affect survival rates of pulpotomy.
- Data was analyzed to at least 48 months to take advantage of available data, especially on ferric sulfate pulpotomies completed in 2016.
- Follow up on NeoMTA is less extensive than ferric sulfate due to the recent introduction of the material to Hennepin Healthcare in 2018.
- Special attention was given to survival at 36 months, including when calculating number needed to treat (NNT), because existing research on pulpotomies typically terminate data collection and analysis at 18 to 24 months. At 36 months, the overall success rate of NeoMTA and ferric sulfate is 94% and 76%, respectively.

Conclusion

- When all three medicaments were compared to one another, there is a statistically significant difference between the survival curves depicting overall and radiographic success rates.
- Longer follow for NeoMTA and Biodentine warranted in order to more accurately compare success rates.

References

- Coll JA, Seale NS, Vargas K, Marghalani AA, Al Shamali S, Graham L. Primary Tooth Vital Pulp Therapy: A Systematic Review and Meta-analysis. *Pediatr Dent.* 2017 Jan 15;39(1):16-123. PMID: 28292337.
- Marghalani, Abdullah A., Samah Omar, and Jung-Wei Chen. "Clinical and radiographic success of mineral trioxide aggregate compared with formocresol as a pulpotomy treatment in primary molars: a systematic review and meta-analysis." *The Journal of the American Dental Association* 145.7 (2014): 714-721.
- Nematollahi, Hossein, et al. "Mineral trioxide aggregate partial pulpotomy versus formocresol pulpotomy: A randomized, split-mouth, controlled clinical trial with 24 months follow-up." *Pediatric dentistry* 40.3 (2018): 184-189.
- Farsi, Deema J., et al. "Sodium hypochlorite versus formocresol and ferric sulfate pulpotomies in primary molars: 18-month follow-up." *Pediatric dentistry* 37.7 (2015): 535-540.