

# The success of emergency pulpotomies in primary molars

Marcio Guelmann, DDS Jodi Fair Clara Turner, DMD Frank J. Courts, DDS, PhD

*Dr. Guelmann is assistant professor, Ms. Fair is a dental student, Dr. Turner is associate professor and program director, and Dr. Courts is associate professor and chair, Department of Pediatric Dentistry, University of Florida, Gainesville, Fla. Correspond with Dr. Guelmann at mguelmann@dental.ufl.edu*

---

## Abstract

**Purpose:** The purpose of this retrospective study was to assess the success of pulpotomies performed on an emergency basis and restored with a temporary zinc-oxide eugenol restorative material.

**Methods:** Records were collected from 216 pulpotomies in primary molars performed on an emergency basis by pediatric dental residents at the University of Florida pediatric dental clinic between July 1999 and June 2001. The selection criteria include teeth with a positive history of pain but with absence of clinical and radiographic signs of pulp degeneration. Formocresol was the medicament used and the teeth were restored temporarily with a reinforced zinc-oxide eugenol material. Treatment success or failure was determined, at the definitive restorative appointment, by the presence or absence of clinical and/or radiographic pathology. The time interval between emergency and definitive treatment appointments, tooth-type, arch, age, and gender were the variables analyzed in this study. Chi-square analysis was used to assess the effect of the different variables on the outcome of the treatment.

**Results:** Sixty-four teeth were available for assessment in the two-year period. A 53% success rate was observed, if the tooth was evaluated and restored with the definitive restoration, within the first 90 days post-emergency treatment. A 31% success rate was observed after 365 days. These results were statistically significant ( $P=0.016$ ). Patients younger than six years old showed statistically significant higher chances for success than older children did ( $P=0.018$ ). No significant differences were found for gender, type of tooth, or arch.

**Conclusions:** The low success rate found during the first three months post emergency treatment may be attributed to undiagnosed, subclinical inflamed pulp, while long-term failure may be associated with microleakage of the temporary restorative material. (*Pediatr Dent* 24:217-220, 2002)

**KEYWORDS:** ENDODONTICS, PRIMARY TEETH, PULPOTOMY

*Received October 23, 2001 Revision Accepted February 1, 2002*

The management of extensive caries and acute discomfort in the primary dentition is a common occurrence for dentists providing dental care for the child patient. Diagnosis and treatment of primary teeth with advanced caries presents a challenge for the dentist due to the difficulty in obtaining a precise pulp diagnosis and the common difficulties in patient management.

During any emergency treatment, an inaccurate diagnosis of pulpal status may result in a questionable prognosis. The histologic condition of the pulp may be advanced beyond the observable clinical and radiographic signs and symptoms.<sup>1</sup> When clinical and radiographic signs of advanced pulp degeneration (abnormal mobility, sinus tract, internal and/or external resorption) are absent, a pulpotomy is recommended to prevent pain as well as preserve function and maintain arch length.

Formocresol continues to be the most popular medicament used for pulpotomies in primary teeth,<sup>2</sup> and the success rates have been clinically acceptable.<sup>3</sup> Numerous studies using a full or diluted concentration have been performed and the tested teeth restored definitively at the same appointment.<sup>4-11</sup> These studies focused on teeth with a negative history of pain. One study, by Mejare,<sup>12</sup> included teeth with coronal or total pulpitis and two different vehicles for the formocresol, one based on zinc oxide eugenol and the other without. Her reported success rate was 55% after 2.5 years.

In most clinical situations when pulpotomies are performed on an emergency basis, a temporary filling material is used and a more definitive restoration is placed during a follow up appointment. In many cases, the follow up evaluation and definitive treatment is provided after a few weeks or months.

**Table 1. Data Distribution**

Age	# Teeth	Gender	# Teeth
<6 yrs.	42	Male	33
>6 yrs.	22	Female	31
Total	64	Total	64
Tooth type	# Teeth	Arch	# Teeth
1 <sup>st</sup> molars	29	Maxillary	16
2 <sup>nd</sup> molars	35	Mandibular	48
Total	64	Total	64
Time interval(days)	# Teeth	Overall results	# Teeth
Up to 90	15	No pathology	39
91-179	21	Pathology	25
180-365	15	Total	64
>365	13	Success	61%
Total	64	Failure	39%

The purpose of this retrospective investigation was to assess the success of formocresol pulpotomies in primary molars when performed on an emergency basis and restored with a temporary restorative material.

### Methods

Data were collected from 216 formocresol pulpotomies in primary molars that were performed on 185 patients on an emergency basis. The treatment was provided by pediatric dental residents under faculty supervision at the University of Florida pediatric dental clinic between July 1999 and June 2001. The selection criteria included restorable primary molars with deep caries, positive history of elicited or spontaneous pain, absence of abnormal mobility, sinus tract, and swelling. Radiographically, the decay was in close approximation to the pulp, the roots showed no signs of external or internal resorption, and there was no furca radiolucency. The recommended treatment was explained to the parent(s) and parental consent was obtained. Local anesthesia was achieved and a rubber dam placed.

Caries removal and coronal access into the pulp chamber was performed with a #330 high-speed bur with water spray. Pulp amputation was performed with a large round bur on a low-speed handpiece. The pulp chamber was cleaned by rinsing with water and use of high-volume suction. Hemostasis was obtained with dry cotton pellets and light pressure.

After achieving hemostasis, cotton pellets moistened with full concentration formocresol (Buckley's solution) were placed in the pulp chamber for 3-5 minutes then removed. A thick mixture of a reinforced zinc oxide eugenol material (IRM, Dentsply/Caulk, Milford, DE, USA) was prepared and condensed, filling the pulp chamber up to the occlusal surface. After setting of the material, the occlusion was adjusted. The parent was encouraged to schedule the child for placement of the definitive restoration (stainless steel crown).

At the follow-up appointment, success of the pulpotomy was defined by absence of clinical or radiographic pathology and no reported symptoms. Failure of the pulpotomy was defined when one or more of the following signs was present: internal root resorption, furcation radiolucency, periapical bone destruction, pain, swelling, or sinus tract.<sup>8</sup> After placement of the stainless steel crown, no further follow up information was obtained.

The time between emergency and definitive treatment, patients' age, tooth type, and arch were the variables analyzed in the study. Chi-square analysis was used to assess the effect of different variables on the outcome of the treatment. Significance was set at  $P < 0.05$ .

### Results

During the two-year period, 59 patients (30 males and 29 females with a total of 64 pulpotomies), returned for definitive treatment. These teeth were clinically and radiographically evaluated for final restorations. The remaining were lost to follow-up. Thirty-nine of the 64 teeth were considered to have a successful pulpotomy therapy and a stainless steel crown was placed. A summary of the data is presented in Table 1.

The interval between treatments (emergency and definitive) was divided into four periods: up to 90 days; from 91 to 179 days; from 180 to 365; and more than a year (Fig 1). The average time interval between treatments was 212 days. A 53% success rate (8/15) was observed within the first 90 days following emergency treatment. A 31% success rate (4/13) was found after 365 days. These results were statistically significant ( $P = 0.016$ ). When the early failures (<90 days) were eliminated, the increase failure rate after 365 days was significant when compared to the intermediary (91 to 365 days) period ( $P = 0.005$ ).

Figures 2 and 3 show the distribution of data by age, gender, tooth type, and arch, respectively. Patients' age varied between 3 and 10 years, with the mean age of 6 years. Patients younger than 6 years showed statistically significant higher chances for success than older children did ( $P = 0.018$ ). No significant differences were found for gender, type of tooth, or arch.

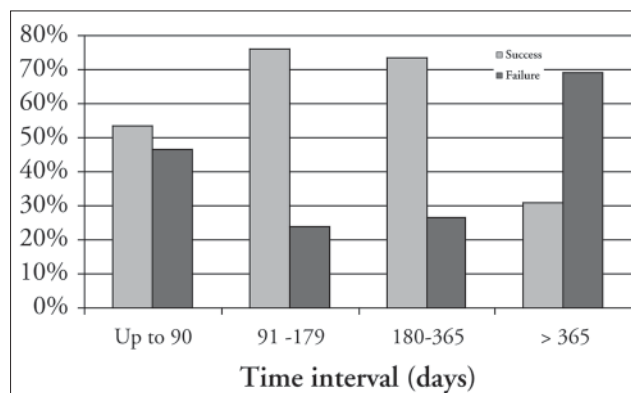


Fig 1. The success of emergency pulpotomies as a function of time

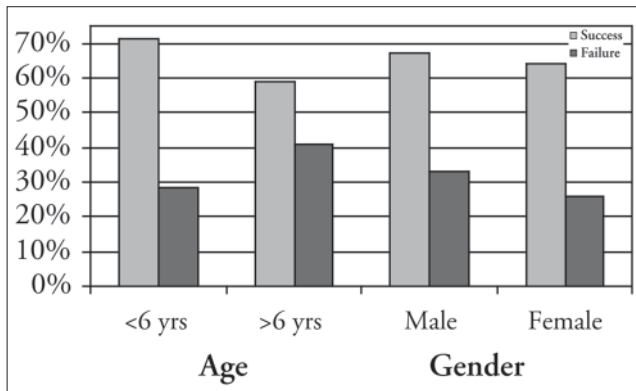


Fig 2. The success of emergency pulpotomies as a function of age and gender

Also, it was noted that, of the 185 treated patients, 124 (67%) had Medicaid coverage. The remaining 61 patients were private pay (24%) or were covered by a different type of insurance (9%). For the definitive treatment, 40% (49/124) of patients covered by Medicaid were available for follow-up.

### Discussion

Diagnosis of pulp inflammation involves the taking and recording of a medical and dental history, an analysis of the results of various pulp tests, radiographic findings, and a clinical oral examination. However, there is no clinical sign or symptom that designates the histopathologic status of the pulp with certainty.<sup>1</sup> In a pediatric population, especially among very young children, reliable pulp tests are difficult to obtain and not routinely done.

Besides deep caries and spontaneous pain, the cases performed in this study did not reveal any radiographic or clinical signs of pulp pathology, and upon pulp amputation hemostasis was obtained within normal time. The low success rates obtained in this study were similar to the one obtained by Mejare,<sup>12</sup> 61% and 55%, respectively. In Mejare's study, as in this study, teeth were not restored definitively during the observation period.

The influence of immediate placement of a definitive restoration on teeth receiving pulp therapy was evaluated by Farooq et al,<sup>10</sup> in a study comparing formocresol pulpotomies and indirect pulp cappings in primary molars. When a stainless steel crown was placed at the same visit as the pulpotomy procedure, the success rate was 82%, which was significantly different than the success rate (39%) when IRM was placed as a temporary filling. In this study, it was also decided to analyze the success based on time interval between appointments. The high failure rate obtained in the first 3 months following emergency treatment may be attributed to an undiagnosed, subclinical inflamed pulp status,<sup>1</sup> while long-term failure may be associated with microleakage of the restorative material.

Regardless of the treatment provided, when a temporary restoration is performed, the filling material must provide an adequate seal against ingress of fluids, organic material, or bacteria from the oral cavity. Different temporary restorative

materials have been tested in a variety of laboratory studies in an effort to identify the material that provides the best coronal-apical seal.<sup>13-16</sup> The results are controversial, but all studies concluded that IRM is not a good sealing material when compared to Cavit®, Term®, and Ketac Fil®. Very good seal results were obtained when IRM was combined with Ketac Fil.<sup>14</sup>

When different powder-liquid (P/L) ratios of IRM were tested for microleakage of endodontic access preparations, the use of a lower P/L ratio, 2 g/ml, demonstrated less microleakage than the other groups.<sup>13</sup> In this study, the data suggests that the early failures, up to three months, may be attributed to the inflammatory status of the pulp. In the long term, failures may be associated with the temporary filling material. Different temporary restorative materials from the one reported in this study should be tested to challenge this hypothesis.

Another important aspect of this study was the low population compliance, especially among the Medicaid insured. The chances that these patients sought treatment in a different clinic were very remote due to the low number of Medicaid providers in the area. Primosch et al<sup>17</sup> also reported poor compliance of a Medicaid-covered population regarding dental rehabilitation of children under general anesthesia. Gibson et al,<sup>18</sup> in a survey of 250 patients who received emergency dental care at a university hospital dental clinic, found 80% success in resolving pain 24 to 48 hours after treatment. However, the original emergency problem did not motivate a large number of these patients to seek further dental care.

### Conclusions

1. A high failure rate was obtained when pulpotomies were performed in primary molars under acute conditions and restored with an IRM temporary restoration.
2. In situations with low patient compliance, whenever possible it is recommended to place a definitive restoration (stainless steel crown) at the same appointment that the pulpotomy is performed.

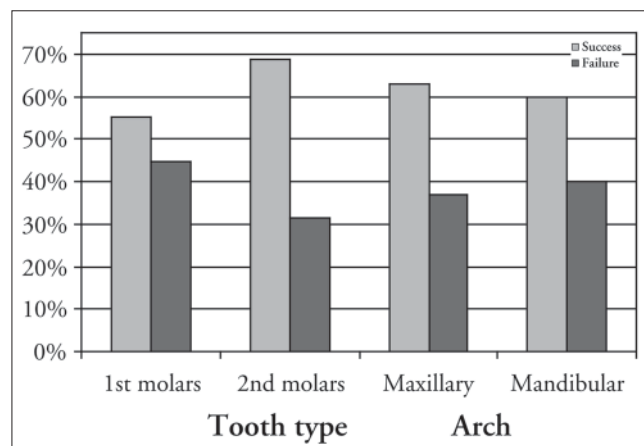


Fig 3. The success of emergency pulpotomies as a function of tooth type and arch

## References

1. Seltzer S, Bender IB. Histologic classification of pulp diseases and differential diagnosis. In: *The Dental Pulp*. 2<sup>nd</sup> ed. Philadelphia: JB Lippincott Company; 1975:315-345.
2. Primosch RE, Glomb TA, Jerrell RG. Primary tooth pulp therapy as taught in predoctoral pediatric dental programs in the United States. *Pediatr Dent* 19:118-122, 1997.
3. Ranly DM, Garcia-Godoy F. Current and potential pulp therapies for primary and young permanent teeth. *J Dent* 28:153-161, 2000.
4. Redig DF. A comparison and evaluation of two formocresol pulpotomy techniques utilizing "Buckley's" formocresol. *J Dent Child* 35:22-30, 1968.
5. Rolling I, Thylstrup A. A 3-year clinical follow-up study of pulpotomized primary molars treated with formocresol technique. *Scand J Dent Res* 83:47-53, 1975.
6. Morawa AP, Straffon LH, Han SS, Corpron RE. Clinical evaluation of pulpotomies using dilute formocresol. *J Dent Child* 42:360-363, 1975.
7. Willard RM. Radiographic changes following formocresol pulpotomies in primary molars. *J Dent Child* 43:414-415, 1976.
8. Fuks AB, Bimstein E. Clinical evaluation of diluted formocresol pulpotomies in primary teeth of school children. *Pediatr Dent* 3:321-324, 1981.
9. Boeve C, Dermaut L. Formocresol pulpotomy in primary molars: a long-term radiographic evaluation. *J Dent Child* 49:191-196, 1982.
10. Farooq NS, Coll JA, Kuwabara A, Shelton P. Success rates of formocresol pulpotomy and indirect pulp therapy in the treatment of deep dentinal caries in primary teeth. *Pediatr Dent* 22:278-286, 2000.
11. Wright FAC, Widmer RP. Pulpal therapy in primary molar teeth: a retrospective study. *J Pedod* 3:195-206, 1979.
12. Mejare I. Pulpotomy of primary molars with coronal or total pulpitis using formocresol technique. *Scand J Dent Res* 87:208-216, 1979.
13. Anderson RW, Powell BJ, Pashley DH. Microleakage of IRM® used to restore endodontic access preparations. *Endod Dent Traumatol* 6:137-141, 1990.
14. Barthel CR, Strobach A, Briedigkeit H, Göbel UB, Roulet JF. Leakage in roots coronally sealed with different temporary fillings. *J Endod* 25:731-734, 1999.
15. Barkhordar RA, Stark M. Sealing ability of intermediate restorations and cavity design used in endodontics. *Oral Surg Oral Med Oral Pathol* 69:99-101, 1990.
16. Mayer T, Eickholz P. Microleakage of temporary restorations after thermocycling and mechanical loading. *J Endod* 23:320-322.
17. Primosch RE, Balsewich CM, Thomas CW. Outcomes assessment—an intervention strategy to improve parental compliance to follow-up evaluations after treatment of early childhood caries using general anesthesia in a Medicaid population. *J Dent Child* 63:102-108, 2001.
18. Gibson GB, Blasberg B, Altom R. A prospective survey of hospital ambulatory dental emergencies. Part 2: Follow-up to emergency treatment. *Spec Care Dentist* 13:110-112, 1993.

## ABSTRACT OF THE SCIENTIFIC LITERATURE



### ORAL HEALTH STATUS AND ORAL HEALTH BEHAVIORS IN CHINESE CHILDREN

The objectives of the study were to evaluate the oral health status and treatment needs of the 5- to 6-year-old and 12-year-old children in Southern China. The study sample was composed of 1,587 5- to 6-year-old and 1,576 12-year-old urban and rural schoolchildren living in Guangdong Province. Caries prevalence of the 5- to 6-year-old children was high (urban 78% vs. rural 86%), and the mean DMFT of the urban and rural children was 4.8 and 7.0, respectively. The caries prevalence and mean DMFT score of the 12-year-olds were 41% and 0.9 (urban areas) and 42% and 0.9 (rural areas). Only 2% of the 12-year-olds exhibited no calculus or gingival bleeding, while more than 70% had calculus. The authors concluded that there is an urgent need for establishing caries-preventive activities for preschool children.

**Comments:** China, as one of the most populated developing countries, is experiencing a significant increase of caries prevalence in children. The development of this trend needs to be carefully monitored, although the prevalence of caries among the 12 year olds was not high. Unless an effective preventive program is established soon enough, it is very likely to see a sky-rocketing of caries rate among the 12 year olds in the next few years. CSH

*Address correspondence to Wong MC, Faculty of Dentistry, The University of Hong Kong, Prince Philip Dental Hospital, Hong Kong.*

Wong MC, Lo EC, Schwarz E, Zhang HG. Oral health status and oral health behaviors in Chinese Children, *J Dent Res* 2001, May;80(5):1459-65.

35 references