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An in Vivo Evaluation of the Clinical Success Rates of Mineral Trioxide Aggregate and Formocresol in pulp Therapies of Deciduous Teeth- an Original Research Study

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Abstract--This in vivo study was conducted to evaluate the clinical success rates of mineral trioxide aggregate and formocresol in pulp therapies of deciduous teeth. Total 40 patients were studied including male and female patients in the age range of 5 to 8 years. One deciduous decayed molar per patient evaluated. Pulpotomy was endeavored very cautiously to avoid any post operative complications. Group 1 has 20 deciduous molars treated with formocresol whereas Group 2 has 20 deciduous molars treated with mineral trioxide aggregate. Patients were reevaluated for clinical and radiographic outcomes in their post operative phases at different timings. Date and

other details were subjected to basic statistical analysis. P value less than 0.05 considered as significant ($p < 0.05$). Results confirmed that in the age group of 5 years, there were 6 male and 4 female patients. P value was highly significant for that (0.01). In addition, p value was highly significant (0.01) for evaluation done at 10 months post operative phase in group 1. P value was very significant (0.02) for evaluation done at 10 months post operative phase in group 2. Likewise, p value was highly significant (0.01) for evaluation done at 15 months post operative phase in group 2. In general, radiographic and clinical success rate for MTA was superior. Teeth treated with MTA showed higher success rates than formocresol. Nonetheless, samples of both groups demonstrated acceptable success rates.

Keywords---Formocresol, Mineral Trioxide Aggregate, Pediatric, Deciduous.

Introduction

Whenever carious involve the underlying pulp, pulp responds by inflammatory procedure nearby caries activity. In case the concerned root canals are not directly involved then pulpotomy is the treatment of choice. Formocresol has been well accepted as pulpotomy agent in the deciduous teeth since past 55 years. Currently formocresol is known as the most unanimously recommended material for pulp therapy for deciduous teeth.^{1,2} The basic ideology of pulp therapy in deciduous dentition is that dentition must be maintained in non-pathological healthy situation to execute its intended functions. Pulpotomy is primarily advised when caries elimination ends up in pulpal exposure of deciduous tooth. This can be seen with standard or reversible pulpitis or irreversible pulpitis.^{3,4} Generally, the crown portion of pulpal tissue is cleaned and residual radicular pulp tissue is checked for vitality by clinical and radiographic means. Literature has well explained that the major objective in pedodontic dentistry is to sustain deciduous dentition in a healthy condition until permanent dentition erupts.^{5,6} Deciduous dentition is necessary for preservation of alveolar bone length, chewing, phonation and smile. Few of the studies also claim that deciduous dentition play a key role in perpetual prevention of anomalous oral habits. Any type of pulp infections and disturbance may lead to non-vital condition.^{7,8} Despite of the fact that formocresol is very good material, many of the endodontists and practitioners have experienced several problems associated with formocresol. Pulp response is unusual with formocresol when associated necrosis, systemic issues. These days MTA is being extensively practiced due to its brilliant biological characteristics and capability to stimulate dentinal regeneration.^{3,7,9} This in vivo study was conducted to evaluate the clinical success rates of mineral trioxide aggregate and formocresol in pulp therapies of deciduous teeth.

Materials and Methods

The present study was abstracted, planned and executed to evaluate the clinical success rates of mineral trioxide aggregate and formocresol in pulp therapies of deciduous teeth. The ultimate purpose of the study explained in detail to the

parents of participating pediatric patients. Total 45 patients were selected in the study by simple random sampling method. Teeth with hopeless prognosis and those associated with abscess and any peri-apical lesions were extracted with surgeon's support. Subsequently, all bony sockets were also compressed sensibly. Hence final sample size was 40. Both male and female patients were studied in the age range of 5 to 8 years. Informed consent was taken from the legal guardians or parents of the patients. Initially, study format was set and presented to institutional ethical committee for approval. Following approval, study initiated. Total 23 male and 17 female patients in were included in the studied for intended parameters. One deciduous molar (with caries) per patient studied. Only asymptomatic and carious teeth were included in the study. Exclusion criteria included presence of pulpal degeneration, radiographic confirmation of pulp stone or internal resorption. Therapy was started with careful excavation and evaluation of caries. After complete caries removal, an access opening was created to reach out canals. Following removal of coronal pulp, localized bleeding was managed successfully. Pulpotomy was completed very carefully to avoid any post operative complications related to canal. For assessing clinical success rates, sample teeth were divided into two study groups. Group 1 has 20 deciduous molars treated with formocresol while Group 2 has 20 deciduous molars treated with mineral trioxide aggregate. In group 1, sterile cotton with formocresol was positioned over the root canal orifices for five minutes approximately. The pulp orifices were later covered by zinc oxide-eugenol paste. MTA paste was prepared by mixing MTA powder with sterile water at a 3:1 ratio exactly as per manufacturer's instruction. In group 2, mineral trioxide aggregate was applied over the canals. Patients were reassessed in their post operative visits for clinical and radiographic findings. The clinical and radiographic assessment was completed by two independent examiners at follow up who were blind to the group being studied. Based on the cumulative inferences, the applied therapy was declared successful or failed. Patients were screened at predetermined post operative intervals of 5, 10, 15, 20 and 25 months. Results were entered in spread sheet and subjected to basic statistical analysis. P value less than 0.05 considered as significant ($p < 0.05$).

Statistical Analysis and Results

All the gathered data and details were sent for statistical assessment using statistical software Statistical Package for the Social Sciences version 22 (IBM Inc., Armonk, New York, USA). The resultant details was subjected to exact statistical tests to obtain p values, mean, standard deviation, chi-square test, standard error and 95% CI. Early assumptions of the study were very important. Table 1 and Graph 1 showed that all patients were in the age range of 5 to 8 years. Total 4 age groups were acknowledged with 23 male and 17 female patients. In the age group of 5 years, there were 6 male and 4 female patients. P value was highly significant for that (0.01). Minimum 8 patients were seen in the age group of 7 years. Eventually, 5 male patients were there in this group. P value was not significant for that (0.08). For age group 8 years, p value was highly significant (0.01). Table 2 show basic statistical descriptions showing mean, standard deviation, standard error, 95% coefficient of interval, Pearson Chi-Square Value and Level of Significance (p value) for Group 1; formocresol/n=20 at 5, 10, 15, 20 and 25 months. P value was highly significant (0.01) for assessment done at 10 months post operative phase. Similarly, p value was highly significant

(0.01) for assessment done at 15 months post operative phase. Likewise, p value was highly significant (0.03) for assessment done at 25 months post operative phase. The overall radiographic and clinical success rate for formocresol was fair only. Table 3 show fundamental statistical descriptions showing mean, standard deviation, standard error, 95% coefficient of interval, Pearson Chi-Square Value and Level of Significance (p value) for Group 2; MTA/n=20 at 5, 10, 15, 20 and 25 months. P value was highly significant (0.02) for assessment done at 10 months post operative phase. Similarly, p value was highly significant (0.01) for assessment done at 15 months post operative phase. Likewise, p value was highly significant (0.02) for assessment done at 25 months post operative phase. The overall radiographic and clinical success rate for MTA was good.

Table 1
Age & Gender wise allocation of patients

| Age Groups (Yrs) | Male | Female | Total | P value |
|------------------|------|--------|-------|--------------|
| 5 | 6 | 4 | 10 | 0.01* |
| 6 | 7 | 5 | 12 | 0.10 |
| 7 | 5 | 3 | 8 | 0.08 |
| 8 | 5 | 5 | 10 | 0.01* |
| Total | 23 | 17 | 40 | *Significant |

Table 2
Basic statistical descriptions showing mean, standard deviation, standard error, 95% coefficient of interval, Pearson Chi-Square Value and Level of Significance (p value) [for Group 1: formocresol: n=20] 5, 10, 15, 20 and 25 months

| Time/M onths | Succe ss [n] | Mean | Std. Dev. | Std. Err. | 95% CI | Pearson Chi-Square Value | df | Level of Sig. (p value) |
|--------------|--------------|-------|-----------|-----------|--------|--------------------------|-----|-------------------------|
| 5 | 10 | 0.284 | 0.647 | 0.988 | 1.18 | 1.029 | 1.0 | 0.10 |
| 10 | 11 | 0.587 | 0.252 | 0.650 | 1.22 | 1.303 | 2.0 | 0.01* |
| 15 | 11 | 0.690 | 0.443 | 0.804 | 1.35 | 2.540 | 1.0 | 0.01* |
| 20 | 12 | 0.712 | 0.112 | 0.145 | 1.11 | 1.935 | 1.0 | 0.50 |
| 25 | 13 | 0.190 | 0.343 | 0.804 | 1.55 | 2.200 | 1.0 | 0.03* |

*p<0.05 [Sig]

Table 3
Basic statistical descriptions showing mean, standard deviation, standard error, 95% coefficient of interval, Pearson Chi-Square Value and Level of Significance (p value) [for Group 2: MTA: n=20] 5, 10, 15, 20 and 25 months

| Time/M onths | Succe ss [n] | Mean | Std. Dev. | Std. Err. | 95% CI | Pearson Chi-Square Value | df | Level of Sig. (p value) |
|--------------|--------------|-------|-----------|-----------|--------|--------------------------|-----|-------------------------|
| 5 | 11 | 0.243 | 0.647 | 0.425 | 1.24 | 1.139 | 1.0 | 0.40 |
| 10 | 12 | 0.539 | 0.746 | 0.604 | 1.03 | 1.653 | 1.0 | 0.02* |
| 15 | 12 | 0.603 | 0.439 | 0.122 | 1.53 | 1.430 | 1.0 | 0.01* |

| | | | | | | | | |
|----|----|-------|-------|-------|------|-------|-----|-------|
| 20 | 15 | 0.525 | 0.123 | 0.847 | 1.12 | 1.955 | 2.0 | 0.90 |
| 25 | 16 | 0.134 | 0.366 | 0.477 | 1.89 | 1.830 | 2.0 | 0.02* |

*p<0.05 [Sig]

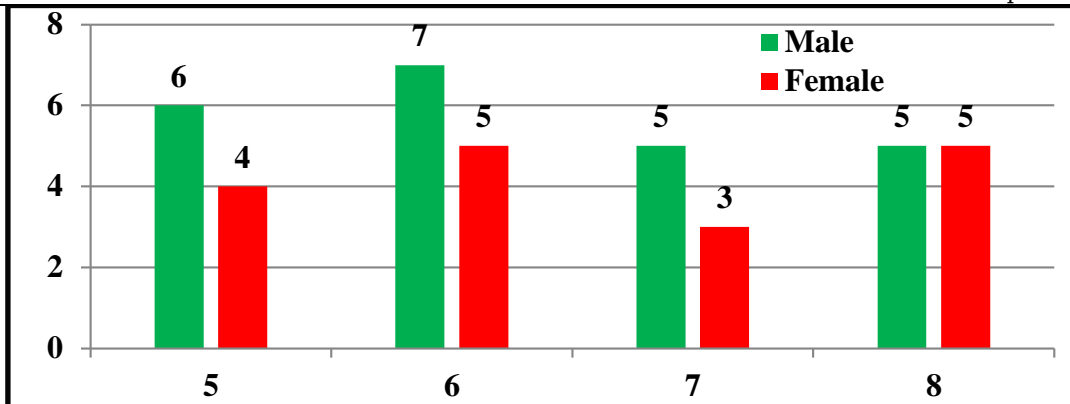


Figure 1. Age & Gender based distribution of patients

Discussion

Many of the classic studies have demonstrated that tooth decay and external insults may cause the dental pulp to exhibit irreversible symptoms. All these procedures can eventually lead to early loss of a tooth. As mentioned in the leading textbooks, the major aim in pedodontic dentistry is to preserve the deciduous dentition in healthy condition. Additionally, conservation of pulp tissue is of extreme importance for normal workings.¹⁰ Pulpotomy is defined as complete removal of coronal portion of the dental pulp followed by the placement of suitable dressing or medicament that will promote healing and preserve vitality of the tooth. Pulpotomy procedure actually fulfills these requirements by utilizing different agents placed directly on pulp tissue.¹¹ Since seventies, formocresol has been extensively used as a pulpotomy material. Formocresol is popular as the gold standard medicament for pulpotomy procedures. However, researchers have raised few serious clinical issues related to safety.¹² These safety concerns have been thoroughly studied in the recent past. Most of these concerns were not focused around its clinical efficiency but about the safety. Several alternative materials have been tried in an attempt to explore best alternative of formocresol.¹³ It was a meticulous task since this alternative material should be equally efficient but without the adverse effects of formocresol. Mineral Trioxide Aggregate was originally introduced in 1993.¹⁴ Mineral Trioxide Aggregate is very valuable in various clinical situations like pulp capping and pulpotomy. The major components of Mineral Trioxide Aggregate are tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicon di-oxide.¹⁵ In recent times Mineral Trioxide Aggregate is being extensively debated and studied material because of its superb biological behaviors and capacity to stimulate tissue regeneration. Many of the pioneer workers have also stated that Mineral Trioxide Aggregate has unique clinical and biological characteristics which make it clinically acceptable with minimum complications.¹⁶

Conclusion

Within the limitations of the present study, authors concluded that formocresol and MTA have clinically and radiographically acceptable success rates for therapeutic management of deciduous teeth. However, the MTA showed higher success rates than formocresol. Nevertheless, the study assumptions of this study should be correlated symptomatically while estimating overall success rate of similar situations.

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