THE USE OF FLUORIDE VARNISH FOR CARIES PREVENTION IN PRESCHOOL CHILDREN IN PRIMARY CARE SETTINGS IN THAILAND

W Asawakun
Ratchaburi province, Thailand

SUMMARY: In Thailand, dental caries remains the most common chronic disease of childhood and leads to health, learning, and quality of life issues. From the Sixth National Oral Health Survey of Thailand, 90% of preschool children (aged 3–5 yr) needed dental treatment by dental personnel. The aims of this study were to clarify the use of fluoride (F) varnish for caries prevention in the primary care setting, while minimizing the likelihood of enamel fluorosis, and to study the interactive effects between the psychological characteristics and family situations of mothers and the utilization of oral health services for preschool children. The study, with a correlational-comparative design, was conducted in 5 provinces: Chiangmai, Ratchaburi, Saraburi, Khon Kaen, and Songkhla. The sample studied consisted of 913 mothers of 3–5 yr-old children and their 913 children. The oral health of the children was examined by dentists. Thirteen questionnaires, with the Likert summated rating method, were given to the mothers. The hypotheses were tested by statistical analyses of the data: three-way analysis of variance, stepwise multiple regression analysis, and path analysis. The results showed that the children who had better dental health had mothers who brought them regularly to the district health promotion hospital to receive F varnish applications. In group 1, consisting of 607 children who had received at least one F varnish treatment, 37.73% were caries free while in group 2, consisting of 306 children who had never received a fluoride varnish treatment, only 26.80% were caries-free (p=0.0011). After eliminating the confounding effect of the behaviour of the mothers in obtaining oral health services for their children, the mean dmft for 112 children in group 1 was 3.81 and while the mean dmft for 215 children in group 2 was 4.33 (p<0.0001). None of 913 children examined in the study had dental fluorosis.

Key words: Fluoride varnish; Fluorosis; Preschool children; Primary care setting; Thailand.

INTRODUCTION

In Thailand, dental caries remains the most common chronic disease of childhood and leads to health, learning, and quality of life issues.1,2 From the 6th National Oral Health Survey of Thailand, dental caries were present in 61.37% of 3 year-old children and 80.64% of 5 year-old children while 90% of 3–5 year-old children needed dental treatment.3 From the survey of the National Statistical Office, the provision of oral health services to preschool children was very low (2.0% in 2006 and 2.3% in 2011).4 Asawakun et al.5 and Asawakun6 found that mothers were the most important persons in dental health care behavior for preschool children and that many psychological factors correlated with maternal behavior. A conceptual framework of how the dental health of preschool children may be affected by maternal psychological traits and states, maternal biosocial characteristics, and the oral health services for preschool children is shown in Figure 1.

---

aFor correspondence: Worrawan Asawakun, Regional Health Promotion 4, Department of Health, Ministry of Public Health, Ratchaburi province, Thailand; E-mail: asawakun@yahoo.com
Future orientation is defined as a way of thinking which is composed of three important components, involving (i) expectation of future events, (ii) awareness of the importance of time and deadlines, and (iii) valuing the future rewards as highly as the present benefits. Self control is defined as the skills necessary to achieve the final and future goal and consists of several steps involving (i) starting from planning and forming subgoals, (ii) manipulating the environment and creating the situations necessary for the performances until the first subgoal is achieved. (iii)
repeating the previous steps to obtain other later subgoals until the final goal is realized, and finally (iv) self reward for the successful performance.⁷ These traits and skills of future orientation and self control have been found necessary for most types of behavior in many research studies in Thailand.⁸ Future orientation is very important in health behavior. People who had high scores in future orientation will do their best to live well today so that they will have good health in the future. e.g., a mother who brings her child to receive a F varnish application to prevent dental caries so that her child will have good teeth in the future.

In Thailand, one national dental caries preventive program was the implementing of a F varnish application for children, aged 9 months to 5 yr, in district health promotion hospitals and child development centers.⁹,¹⁰ The decision to apply topical fluoride should be based on an assessment of dental caries risk, and the F varnish should ideally be applied by a dental or medical professional as part of a comprehensive, continuously accessible, and coordinated oral health care program.¹¹,¹² F varnish applied every 6 months is effective in preventing dental caries in the primary and permanent teeth of children at moderate to high risk for dental caries. For those at high risk, receiving F varnish every 3 months may provide an additional caries-prevention benefit.¹³,¹⁴ F varnish, in comparison with gels or foams, is applied easily, sets quickly, and is less likely to be swallowed by young children.¹⁵,¹⁶ This is especially advantageous in young children, in children or adults with special health care needs, and in public health programs.¹⁶ Therefore, it is interesting to study the effect of psychological factors associated with maternal behavior on oral health services for preschool children and the quality of the evidence for using F varnish for caries prevention. The aims of the present study were:

1) to study the interactive effects on oral health services behavior of children, aged 3–5 yr, of maternal psychological traits and states, the situation of the oral health services unit, and the family situations of mothers

2) to clarify the efficacy of the use of fluoride varnish for caries prevention in the primary care settings while minimizing the likelihood of enamel fluorosis.

MATERIALS AND METHODS

The study was a correlational-comparative study based on a conceptual research framework of an interactionism model and was conducted in 5 provinces: Chiangmai, Ratchaburi, Saraburi, Khon Kaen, and Songkhla. The sample studied consisted of 913 mothers of 3–5 year-old children and their 913 children. An invitation letter and a permission letter for the dental examination of their children were sent to the mothers of the 3–5 year-olds. Thirteen questionnaires with the Likert summated rating method were given to the mothers in school meeting rooms. The oral health of the children was examined by dentists who used a WHO form (dmft index that expressed the number of affected teeth in primary dentition, with a score range of 0–20 for each individual; dmft = 0 caries free, low score on dmft = low dental caries status, high score on dmft = high dental caries status). In Thailand, there is one national dental caries preventive program (free of charge)
for the implementing of a F varnish application for children, aged 9 months – 5 yr, in district health promotion hospitals and child development centers. In this study, data were collected for two groups of children who, according to the information in the questionnaires answered by their mothers, had either (i) (group 1) received at least one F varnish treatment from the government oral health services unit or (ii) (group 2) had never previously received a F varnish treatment.

For data analysis, the statistics used in this study were percentage, mean, Fisher’s exact test, three-way ANOVA, multiple regression analysis (stepwise and totaled) and path analysis. All the factors were used in the path analysis to test the consistency of the interactionism model. The linear structural relations statistical software package LISREL was used to analyze the results for psychological traits, psychological states, the situation of the oral health services unit, and the family situation factors of the mothers. The path analysis coefficients, obtaining by using LISREL program for the Linear Structural Relationship Model, were derived from a 1921 paper by Wright where a particular diagram-based approach was used to consider the relations between variables in a multivariate system.17 Fisher’s exact test was calculated using GraphPad InStat™, version 3.10.18

RESULTS

There were two major findings:

1) The hypothesized interactionism model was fitted to the empirical data with Chi-square = 17.54, df = 10, p = 0.06, NFI = 0.99, GFI = 0.99, AGFI = 0.96, SRMR = 0.021, and RMSEA = 0.033 and displayed the following results: the psychological traits of mothers was directly effected by the situation of the oral health services unit and the family situation factors of the mothers (path coefficient = 0.398) (Figure 2). The psychological states of the mothers were directly effected by 2 variables, namely, (i) the psychological traits of mothers (path coefficient = 0.489) and (ii) the situation of the oral health services unit and the family situation factors of the mothers (path coefficient = 0.418). The oral health services behavior of the preschool children was directly effected by 3 groups of variables, namely, (i) the psychological states of the mothers (path coefficient = 0.283), (ii) the psychological traits of the mothers (path coefficient = 0.248) and (iii) the situation of the oral health services unit and family situation factors of the mothers (path coefficient = 0.115). These results showed that the psychological traits, the psychological states, the situation of the oral health services unit, and the family situation factors of the mothers affected to the oral health services behavior of the preschool children.
The use of fluoride varnish for caries prevention in preschool children in primary care settings in Thailand

Asawakun

**Situation of the oral health services unit**
- 0.74

**Husband’s support**
- 0.90

**Health news**
- 0.53

**Oral health services for preschool children**
- R² = 0.309

**Psychological traits**
- R² = 0.158

**Psychological states**
- R² = 0.576

**Dental health promotion**
- 0.93

**Oral prevention**
- 0.99

**Dental treatment**
- 0.22

**Future orientation**
- 0.63

**Self control**
- 0.23

**Internal locus of control**
- 0.59

**Knowledge**
- 0.073

**Attitude**
- 1.00

- 0.398* 0.418* 0.489*

- 0.515* 0.313* 0.20 0.893* 0.656*

- 0.688* 0.115 0.57 0.283* 0.248* 0.619*

- 0.093* 1.103*

- 0.269* 0.093*

Chi-square = 17.54, df = 10, p = 0.06, NFI = 0.99, GFI = 0.99, AGFI = 0.96, SRMR = 0.021, RMSEA = 0.033. *p<0.01.

**Figure 2.** Path coefficients of the causal model of oral health services for preschool children.
Table 1. Caries experience (caries free, caries experienced, and mean dmft) and fluoride varnish treatment (group 1: applied, group 2: not applied) in 3–5-year-old children

<table>
<thead>
<tr>
<th>Oral health services obtained (number of children, % of total children, % of group 1 or 2, and mean dmft±SD)</th>
<th>Oral health services not obtained (number of children, % of total children, % of group 1 or 2, and mean dmft±SD)</th>
<th>Number of children, % of total children, and mean dmft±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>F varnish treatment applied (group 1)</td>
<td>229*</td>
<td>38% of group 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25% of total children</td>
</tr>
<tr>
<td>F varnish treatment not applied (group 2)</td>
<td>82*</td>
<td>9% of total children</td>
</tr>
<tr>
<td></td>
<td></td>
<td>27% of group 2</td>
</tr>
<tr>
<td>Number of children, % of total children, and mean dmft±SD)</td>
<td>311</td>
<td>34% of total children</td>
</tr>
</tbody>
</table>

Using Fisher's Exact Test, *p=0.0011

Table 2. Caries experience (mean dmft), fluoride varnish treatment (group 1: applied, group 2: not applied), and use of oral health services (obtained, not obtained) in 3–5-year-old children

<table>
<thead>
<tr>
<th>Oral health services obtained (number of children, % of total children, % of group 1 or 2, and mean dmft±SD)</th>
<th>Oral health services not obtained (number of children, % of total children, % of group 1 or 2, and mean dmft±SD)</th>
<th>Number of children, % of total children, and mean dmft±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>F varnish treatment applied (group 1)</td>
<td>495*</td>
<td>54% of total children</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12% of total children</td>
</tr>
<tr>
<td>F varnish treatment not applied (group 2)</td>
<td>91*</td>
<td>10% of total children</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24% of total children</td>
</tr>
<tr>
<td>Number of children, % of total children, and mean dmft±SD)</td>
<td>586</td>
<td>64% of total children</td>
</tr>
</tbody>
</table>

Using Fisher's Exact Test, *p<0.0001
2) The children who had better dental health were the children whose mothers brought them regularly to the district health promotion hospital to receive fluoride varnish applications. Significantly more children in group 1, consisting of 607 children who had received at least one F varnish treatment, were caries-free (38%) compared to those in group 2, consisting of 306 children who had never received a fluoride varnish treatment (27%, p=0.0011, Table 1). These results showed that F varnish application in preschool children was efficacious in reducing the incidence of early childhood caries incidence.

After eliminating the confounding effect of the behaviour of the mothers in obtaining oral health services for their children, the mean dmft for the 112 children in group 1 was significantly lower at 3.81 than the mean dmft for the 215 children in group 2 was (4.33, p<0.0001, Table 2). None of 913 children in this study had dental fluorosis.

**DISCUSSION**

The study findings support the use of fluoride varnish to prevent early childhood caries and to reduce the caries increment in very young children. The efficacy of fluoride varnish in this age group provides an additional rationale for an early dental visit, especially for high-caries-risk children, since the application of fluoride varnish at this first visit will help reduce future disease. This result is consistent with other studies which also shown that the use of fluoride varnish greatly reduces caries in children.

The application of F varnish has been proven to be an effective method of reducing early childhood caries by protecting teeth, re-mineralizing weakened tooth enamel, and slowing or halting the progression of early decay.

Thus, determining the efficacy of only one application of F varnish a year was important. Although more frequent F varnish applications were more beneficial, one application was preferable to none. Furthermore, the results indicate that the children of mothers who did not receive oral health services, despite exposure to the promotion of oral health services for preschool children (dental health promotion, oral health prevention and dental treatment), were the most at-risk group.

**CONCLUSIONS**

The results from this study indicate that F varnish application is a useful tool in dental caries prevention for preschool children. Since our objective is to provide fluoride to the teeth, and not systemically to the body, the application of F by varnish is an advance as it reduces dental decay without causing dental fluorosis. Moreover, these results have important implications for further research and the design of interventions to reduce dental decay.

**ACKNOWLEDGMENTS**

The help of the Director of the Center for Research and Development of Thai Behavioral System, National Research Council of Thailand, for the conducting of this research, is gratefully acknowledged. The authors are also grateful to the
The use of fluoride varnish for caries prevention in preschool children in primary care settings in Thailand

Asawakun

Department of Health, Ministry of Public Health, Thailand, for financial assistance.

REFERENCES

18. Motulsky HJ. GraphPad Prism 6™. San Diego, CA, USA: GraphPad Software Inc; 2013. URL: http://graphpad.com/company/