

## A Program to Improve the Oral Health of School Children in the Kingdom of Tonga: the MaliMali Program

Reiri Takeuchi<sup>1, 2</sup>, Kohji Kawamura<sup>2, 3</sup>, Sayuri Kawamura<sup>2, 3</sup>, Mami Endoh<sup>2, 4</sup>, Sililo Tomiki<sup>2, 5</sup>,  
Chieko Taguchi<sup>2, 6</sup>, and Seigo Kobayashi<sup>2, 6</sup>

<sup>1</sup>Department of Pharmacology, Nihon University School of Dentistry at Matsudo, 2-870-1 Sakaecho-Nishi, Matsudo, Chiba 271-8587, Japan

<sup>2</sup>South Pacific Medical Team, 3-8-14 Saiwaicho, Kawaguchi, Saitama 332-0016, Japan

<sup>3</sup>Kawamura Dental Office, 3-8-14 Saiwaicho, Kawaguchi, Saitama 332-0016, Japan

<sup>4</sup>Division of Oral Care and Rehabilitation, Kyushu Dental College, 2-6-1 Manazuru, Kokura-Kita, Kitakyushu, Fukuoka 803-8580, Japan

<sup>5</sup>Vaiola Hospital, Ministry of Health, Nuku'alofa, Kingdom of Tonga

<sup>6</sup>Department of Preventive and Public Oral Health, Nihon University School of Dentistry at Matsudo, 2-870-1 Sakaecho-Nishi, Matsudo, Chiba 271-8587, Japan

### Article History

Received 29 March 2012

Accepted 18 April 2012

### Abstract

The South Pacific Medical Team, a voluntary group organized by Japanese dentists, has worked to improve oral health in the Kingdom of Tonga since 1998. Its main activity is the planning and administration of a school-based program known as the MaliMali Program. The MaliMali Program has been promoted by a Tongan team for preventive dentistry from the Dental Office of the Ministry of Health. In the present study, we describe the results of the MaliMali Program and consider its effects from 1998 to 2009.

The MaliMali Program consists of the following three main programs, plus additional activities: an education program for kindergarten and primary school children to prevent caries (including leaflet distribution, lectures, and guidance about eating between meals); a program teaching children about the proper use of toothbrushes and fluoride toothpaste; and a program providing children with fluoride mouth rinse. In the latter program, 7-10 mL of a 0.2% NaF solution was given to children in primary school once a week; 5 mL of a 0.05% NaF solution (Miranol<sup>®</sup>) was given to children in kindergarten once a day. We investigated oral health habits (dietary habits in 2001, toothbrushing habits in 2008), oral conditions (prevalence of dental caries in 2001 and 2007, effectiveness of fluoride mouth rinse for prevention of caries in 2008), and gingivitis and gingival bleeding (in 2003).

In 2008, 34 kindergartens, 101 primary schools (75.4% of all schools in Tonga), and 14,442 children in total participated in the MaliMali Program. In 2008, all children reported brushing their teeth at least once a day. The mean decayed/missing/filled teeth (DMFT) score DMFT and the decayed/missing/filled (DMF) person rate had decreased significantly in 2007 compared to 2001. In 2008, we examined whether fluoride mouth rinse is effective for the prevention of caries and found that fluoride mouth rinse significantly decreased the mean DMFT score. In 2003, 52.0% of children had gingivitis and 20.6% had gingival bleeding.

The MaliMali Program is universally accepted in the Kingdom of Tonga. It has helped to establish children's toothbrushing habits and the application of fluoride has decreased the incidence of caries.

### Keywords :

fluoride mouth rinse, dental caries, school children, the Kingdom of Tonga

### Correspondence to :

Reiri Takeuchi

E-mail : takeuchi.reiri@nihon-u.ac.jp

### Introduction

The Kingdom of Tonga (Tonga) is part of Polynesia in the South Pacific Ocean. It consists of 170 islands divided into

five main island groups: the Tongatapu Islands, including the capital city; the Ha'apai Islands; the Vava'u Islands; the Niua Islands; and the 'Eua Islands. These islands are distributed across an area of 600 km north to south and 200 km east to west. In 1998, the population of Tonga was about 100,000 and 35% of the population was 14 years old or younger. The dental clinical system in Tonga experienced problems, such as shortages of staff, tools, materials, and equipment. As a result, many Tongans had to undergo tooth extraction to treat dental problems that would be treated conservatively in Japan. Despite the limited equipment available in Tonga, prosthesis treatment with dentures after extraction and simple preservation treatment were available. Many Tongans have lifestyle diseases, such as diabetes and circulatory system diseases, which are thought to increase the prevalence of dental diseases, such as dental caries and periodontal disease. Therefore, an oral health system including a preventive program was needed.

The South Pacific Medical Team (SPMT), a volunteer group organized by Japanese dentists, has worked for the improvement of oral health in Tonga in cooperation with the Ministry of Health of the Kingdom of Tonga since 1998. The main activity of SPMT is the planning and administration of a school-based program to improve children's oral health (called the MaliMali Program; MaliMali means "smile" in Tongan). The MaliMali Program consists of the following three main programs in addition to other activities: an education program for kindergarten and primary school children to prevent caries (including leaflet distribution, lectures, and guidance on eating between meals); a program offering toothbrushing guidance and encouragement in using fluoride toothpaste; and a program administering fluoride mouth rinse (FMR). The MaliMali Program has been promoted by the Tongan team for preventive dentistry, which consists of dentists and dental therapists affiliated with the Dental Office of the Tongan Ministry of Health.

In the present study, we describe the results produced by the MaliMali Program from 1998 to 2009 and evaluate the program's effectiveness.

## Materials and Methods

### *MaliMali Program*

Figure 1 shows the structure of the MaliMali Program, the content of its activities, and the cooperative organization of the MaliMali Program. In 1998, the dental section of Vaiola

Hospital, belonging to the Ministry of Health in Tonga, established a section for preventive dentistry and a team to execute the MaliMali Program. The South Pacific Medical Team donates fluoride, toothbrush, dental materials, cars for transportation, and other necessities and plans the program. In 2006, SPMT entered into a contract with the Japan International Cooperation Agency (JICA). Part of the cost of executing the MaliMali Program is covered by funds from this contract. The role of the Ministry of Health in Tonga is to provide a professional workforce (dental officer, dental therapist, dental nurse, and dental technician) and plan the program. The role of the Ministry of Education in Tonga is to transfer materials to teachers in kindergartens and schools, establish time for toothbrushing after lunch, and execute the MaliMali Program in cooperation with the MaliMali team. The role of the MaliMali team is to provide fissure sealant treatment in dental offices, apply fluoride (e. g., administer FMR), instruct children in toothbrushing, provide dental examinations, provide oral health education, hold oral health festivals and workshops, and publicize the MaliMali Program in TV, radio, and newspaper media.

The MaliMali Program proceeds as follows. The MaliMali team visits kindergartens and primary schools once a week, guides children in toothbrushing with help from teachers, and provides the FMR. The MaliMali team also gives presentations on oral health including leaflets and other media in schools twice a year. When the MaliMali team does not visit, the children brush their teeth after lunch under the guidance of their teachers. School-based FMR is administered as follows. Primary school children receive 7-10 mL of 0.2% NaF solution once a week and children in kindergarten receive 5 mL of 0.05% NaF solution (Miranol<sup>®</sup>) once a day. The fluoride solutions, tools, and materials are donated by SPMT. The fluoride solutions are prepared with distilled water every morning by the MaliMali team in the clinic. The amount of fluoride solutions used is recorded in a notebook. In some primary schools, the prepared fluoride solution is also delivered once a week by the MaliMali team and given to students by teachers. This project became a cooperative effort with JICA in 2006 and has been executed in cooperation with the Ministry of Health and Education, Kingdom of Tonga. The project's name is "The Project of Oral Health in the Kingdom of Tonga" (a grass-roots support program involving technical cooperation that lasted from April 2006 to March 2009) and "The Project of Improving School-based Oral Health Activity in the

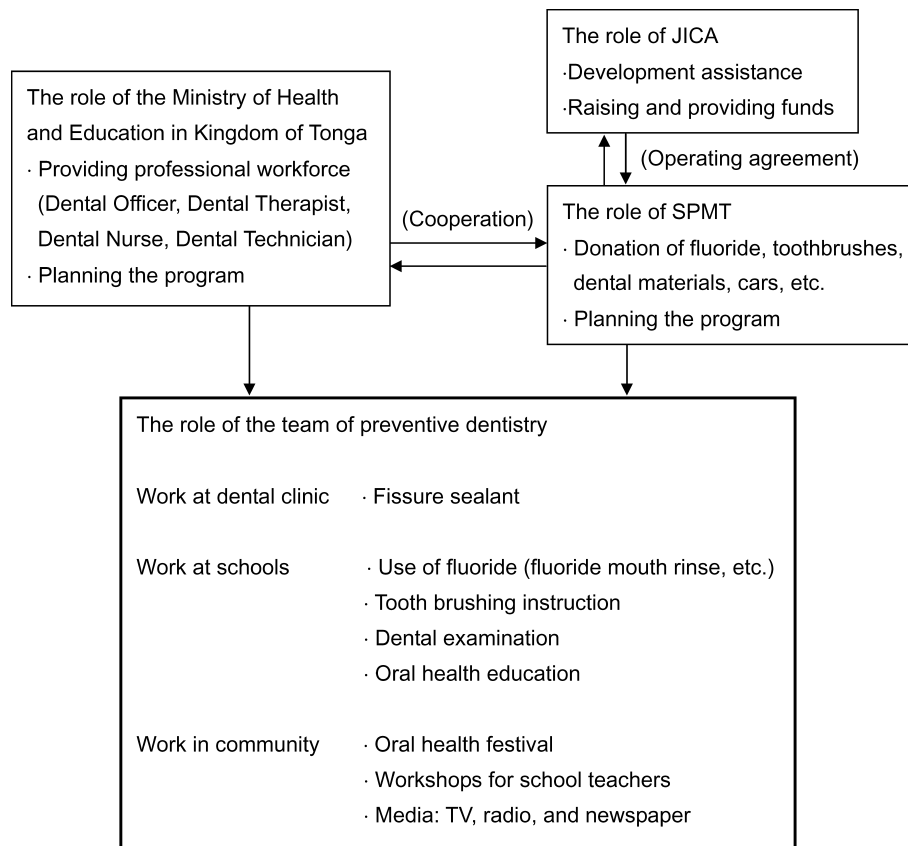


Fig. 1. Structure of the MaliMali Program

Kingdom of Tonga” (a grass-roots follow-up program involving technical cooperation that lasted from February 2010 to March 2012).

#### *Investigation of oral health habits*

##### A) Investigation of dietary habits

In 2001, the dietary habits of 882 children in all classes of six primary schools on Tongatapu Island were studied via a survey. The staffs of the MaliMali team and classroom teachers read aloud the questionnaire for students and filled out the answers on the form. The response rate was 100%.

##### B) Investigation of toothbrushing habits

In 2008, the toothbrushing habits of 829 children in all classes of six primary schools on Tongatapu Island were studied via a survey that was read aloud and filled out by the staff of the MaliMali team and classroom teachers. The target population was children ages 5-14 years who had participated in the MaliMali Program for 1-9 years. The response rate was 100%.

#### *Investigation of oral condition*

##### A) Prevalence of dental caries

###### 1) Comparison between 2001 and 2007

In 2001 and 2007, the prevalence of dental caries was determined. The study population was 12-year-old children: 45 boys and 21 girls in 2001 and 44 boys and 20 girls in 2007. The caries were detected by inspection according to the manual published by the Japanese Society of School Health (1). A dental explorer was used to remove dental plaque and to assess the presence of dental caries.

###### 2) Examination of whether fluoride mouth rinse is effective for the prevention of caries

In August 2008, 10-year-old children in six primary schools on Tongatapu Island underwent dental exams. In total, 109 children were examined (control group: 63 children who had used FMR for less than 1 year; FMR group: 46 children who had used FMR for 5.5 years or more). The examination was performed by one Japanese dentist with a dental mirror, standard dental explorer, flashlight, and sunlight (1). The following items were

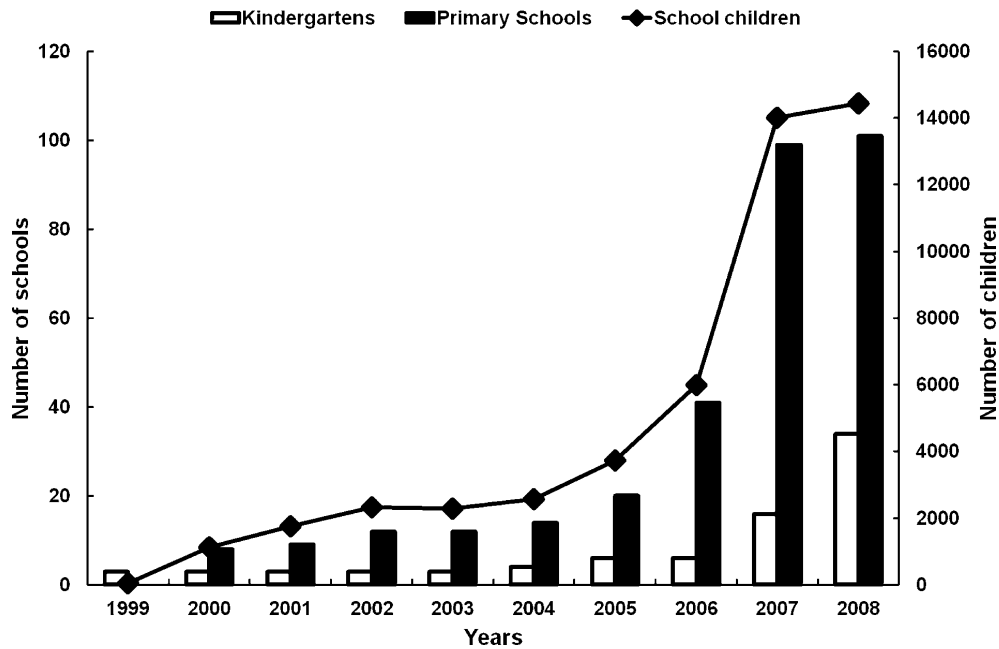


Fig. 2. The number of schools and children enrolled in the MaliMali Program by year in the Kingdom of Tonga

recorded for each tooth surface: sealant filling, C<sub>1-4</sub>, missing by caries, and filling. A stain solution (erythrosine) was used to discriminate among healthy teeth, sealant-filled teeth, and resin-filled teeth. X-ray diagnosis was not used. The “dental caries teeth” item in the results is the number of teeth having an evident cavity. The item “Difference (%) of Mean DMFT” was calculated using the following numerical formula: [(DMFT index of control group – DMFT index of fluoride group) / DMFT index of control group] × 100.

#### B) Evaluation of gingival bleeding and gingivitis

In 2003, gingival bleeding and gingivitis were investigated in 10- to 12-year-old children in eight primary schools on Tongatapu Island who had participated in the MaliMali Program for 1-3 years. A total of 506 children participated (271 boys and 235 girls). The detailed methods are as follows.

- 1) Gingival bleeding was evaluated after rubbing the surface of the cervices of the front teeth with a toothbrush five times according to the Bass method. Gingival bleeding (+) includes slight bleeding. The original method was used because the test must be performed rapidly and easily, and preferably outdoors(2).
- 2) Gingivitis was evaluated using photographs in the clinic. The gingivae of the six front teeth were photographed

under sunlight before evaluation. Gingivitis (+) includes cases showing slight inflammatory symptoms (e. g., redness and swelling).

The protocol was approved by the Committee on Studies Involving Human Beings of the Nihon University School of Dentistry at Matsudo (EC07-012).

## Results

### *Diffusion of the MaliMali Program*

Figure 2 shows the increasing number of kindergartens, primary schools, and school children enrolling in the MaliMali Program every year. The MaliMali Program began with three kindergartens and 44 children in 1999. The enrolled facilities totalled three kindergartens and six primary schools in 2000 and 34 kindergartens, 101 primary schools, and 14,442 children in 2008.

### *Dietary habits*

Table 1 shows the results of the dietary habit investigation in 2001. On Tongatapu Island, the intake frequency of modern foods (e.g., sugar or sweetener, oils and fats, soft drinks) of 15.97 was higher than that of traditional foods (3.91; e.g., green and yellow vegetables, root crops including taro, coconut cream). Among staple foods, the intake frequency of grain (2.45) was higher than that of root crops (0.90). Among modern foods, the intake frequencies of

Table 1. Comparison of intake frequencies between traditional foods and modern foods in 6 primary schools in Tongatapu, 2001 (N=882)

	Average/person-day	
Traditional foods	Root crops (e.g., Taro)	0.90
	Coconut cream	0.88
	Coconut juice	0.07
	Green and yellow vegetables	1.00
	Fruits	0.13
	Seafood	0.06
	Meats	0.63
	Rainwater	0.24
	Total	3.91
	Modern foods	Grain
Sugar or sweetener		5.02
Oils and fats		3.15
Green and yellow vegetables		1.00
Beans		0.03
Seafood		0.06
Meats		0.63
Eggs		0.07
Milk or milk products		0.09
Soft drinks		2.92
Snack foods	0.55	
Total	15.97	

Foods are classified following Adachi et al. (3).

sugar or sweetener (5.02), oils and fats (3.15), and soft drinks (2.92) were high.

#### Toothbrushing habits

Table 2 shows the results of the toothbrushing habit investigation among 5- to 14-year-olds in 2008. All children brushed their teeth at least once per day. Of these children, 17.5% habitually brushed their teeth once a day, 45.6% twice a day, and 36.9% thrice a day or more.

#### Prevalence of dental caries

Table 3 shows the prevalence of dental caries among 12-year-olds in 2001 and in 2007. In 2001, the DMF person rates for boys and girls were 89 and 91, respectively, and the mean DMFT scores for boys and girls were 4.40 and 5.81, respectively. In 2007, the DMF person rate was 70 for both boys and girls, and the mean DMFT score for boys and girls

Table 2. Distribution of daily tooth brushing frequency among 5- to 14-year-old children in Tongatapu, 2008 (N=829)

Daily tooth brushing frequency	(%)
Once	17.5
Twice	45.6
Thrice or more	36.9

Table 3. Prevalence of caries in 12-year-old children in Tongatapu, 2001 and 2007

Sex	2001			2007		
	N	DMF person rate	Mean DMFT	N	DMF person rate	Mean DMFT
Boys	45	89%	4.40	44	70%	1.84
Girls	21	91%	5.81	20	70%	2.10

were 1.84 and 2.10, respectively. Both the DMF person rate and the mean DMFT score decreased significantly for both boys and girls in 2007 from 2001.

#### Prevention of caries by school-based fluoride mouth rinse

Figure 3 shows that the effect of school-based FMR on dental caries among 10-year-olds in 2008. The mean DMFT score of the FMR group (0.87) was significantly lower than that of the control group (1.90) ( $P < 0.01$ ).

#### Prevalence of gingivitis and presence of gingival bleeding

Table 4 shows the proportion of 10- to 12-year-olds who had gingivitis and gingival bleeding in 2003. Of these children, 52.0% had gingivitis and 20.6% had gingival bleeding.

#### Discussion

As shown in Figure 2, the MaliMali Program, of which the main measurable outcome is school-based FMR, began in three kindergartens with 44 children on Tongatapu Island and the Ha'apai Islands in 1999. The program then spread to the Vava'u Islands and the 'Eua Islands. The program was offered at four primary schools on Tongatapu Island and three kindergartens and two primary schools on the Ha'apai Islands in 2000, and by 2008, it had expanded to 34 kindergartens and 101 primary schools (75.4% of all schools in Tonga) with a total of 14,442 students. The numbers of enrolled facilities and children increased notably in 2006 and 2007. This increase might be related to the contract between

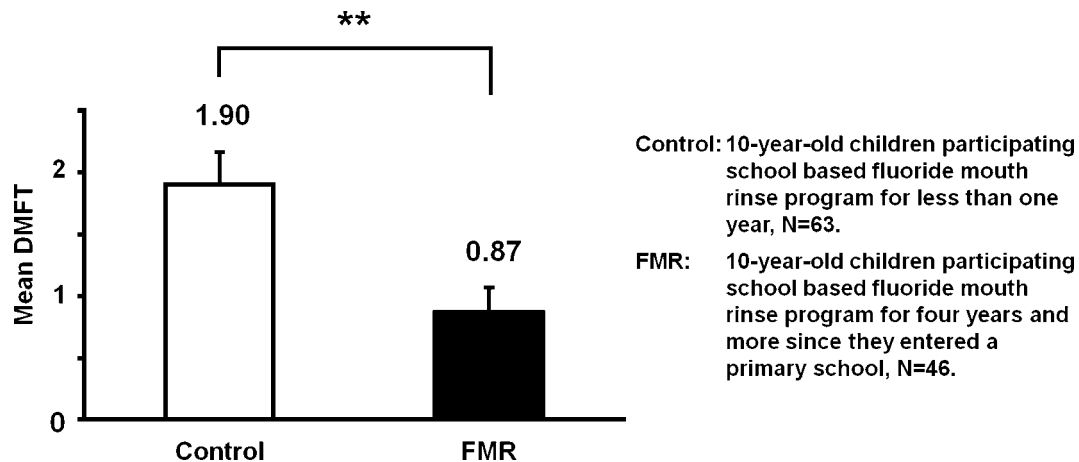


Fig. 3. Comparison of the mean DMFT (S.D.) between the control group and the FMR group  
 \*\*: significant by t-test,  $P < 0.01$

Table 4. The proportions of 10- to 12-year-old children who had gingivitis or gingival bleeding in Tongatapu, 2003 (N=506)

Assessment	Gingivitis (%)	Bleeding (%)
-	48.0	79.4
+	52.0	20.6

SPMT and JICA and the international contract between the Ministry of Health, Ministry of Education, JICA, and SPMT. However, because some primary schools also have pre-school programs, the total numbers of kindergarteners and primary school children are unknown.

As shown in Table 1, in 2001, the intake frequency of grain (in modern foods) was approximately 2.7 times higher than that of root crops (in traditional foods). The difference between the total intake frequencies of modern and traditional foods was around 4.1. In 1979, the intake frequency of grain was about 0.15 times that of root crops and the total intake frequency of modern foods was about 0.36 times that of traditional foods(3). In the past 22 years, Tongans have replaced many traditional foods with modern foods. The intake frequency of sugar or sweetener, meaning sweets that are sweetened with only sugar, was high (5.02). Adachi et al. reported that the intake frequency of sugar or sweetener in 1979 was 0.26 and that Tongans ate grain boiled with saline rainwater and coconut cream without salt or sugar(3). Tongans' sugar intake has increased with the change in their dietary habits. The MaliMali Program advises children to decrease their intake of sugar, sweet drinks, and sweets.

Toothbrushing habits were studied in 2008 (Table 2). Tongans historically did not brush their teeth(3) and few

Tongans did so in 1999; however, all children brushed their teeth once a day or more in 2008. Of the children studied, 145 (17.5%) habitually brushed their teeth once a day, 378 (45.6%) brushed twice a day, and 307 (36.9%) brushed thrice a day or more. However, 50 children who did not respond were excluded. Therefore, it is thought that the MaliMali Program has contributed toward the strong establishment of the toothbrushing habit among Tongan children.

The prevalences of dental caries among 12-year-olds in 2001 and 2007 were compared (Table 3). The mean DMFT scores and DMF person rates for both boys and girls in 2007 were significantly decreased compared to the 2001 values. The mean DMFT score decreased by 58.2% for boys and 63.9% for girls during this period. These changes might have resulted from the activities of the MaliMali Program aimed at decreasing the prevalence of caries: toothbrushing instruction, distribution of fluoride toothpaste, and school-based FMR. These activities were executed principally by the MaliMali team with the support of SPMT.

Whether FMR is effective for the prevention of caries was tested using data from 2008 (Fig. 3). Fluoride mouth rinse significantly decreased the mean DMFT score by 54.0%. Fluoride mouth rinse makes the largest contribution to the prevention of caries of all activities in the MaliMali Program. The effect of school-based FMR has been investigated since the 1970s and researchers have demonstrated that it decreases the incidence of caries in children by 31-70% (4). Twetman et al. and Fukai et al. have also reported that a school-based FMR program has a strong effect on the prevention of caries (5, 6). School-based FMR is very



effective and inexpensive (7, 8). Thus, it might be the best method of preventing caries in developing countries like Tonga. On the other hand, Kobayashi et al. reported that FMR should be started at 4 to 5 years of age to protect the first molars (9-11). The children in the fluoride group started FMR at age 4 years 6 months to 5 years 5 months. Thus, the method of school-based FMR might be appropriate. However, there are several problems with the MaliMali Program that may diminish the effect of school-based FMR on the prevalence of caries. Tonga has fewer days of primary school (175 days; 35 weeks) than Japan does. Because primary school in Tonga is closed when it is raining, the MaliMali Program may not be offered every day or week. Classroom teachers manage children's toothbrushes at school, so when the teacher is not able to work, the children cannot use their toothbrushes and complete the FMR. In addition, a child's toothbrush or FMR may be withheld as punishment. These weaknesses can be addressed in the following ways. The MaliMali team should visit schools on a different day if it rains on the usual day. Fluoride mouth rinse should be administered independently of brushing teeth. The MaliMali Program recommends the use of fluoride toothpaste. The effect of fluoride toothpaste has been investigated since 1945 and it has been demonstrated to be effective for decreasing the prevalence of caries in clinical trials (12, 13). Thus, in addition to establishing a toothbrushing habit, the fluoride toothpaste might contribute to the effective prevention of caries.

The prevalence of gingivitis and presence of gingival bleeding were investigated in 2003 (Table 4). Gingival inflammation was found in 52% of the children and gingival bleeding was found in 20.6%. These conditions were investigated in 10- to 12-year-olds in a primary school in Japan in 2003 (2). This study included 165 children (93 boys and 72 girls). In total, 74.8% of the children had gingivitis and 58.8% of the children had gingival bleeding. The gingivae of Tongan children might be healthier than those of Japanese children. This research was performed to prepare the reference materials for toothbrushing guidance. The original method of assessment was used for rapid and easy investigation without causing the children discomfort.

The MaliMali Program is executed primarily by the MaliMali team. The main activities of this program are enforcement of toothbrushing habits, use of fluoride toothpaste, and administration of FMR in kindergartens and primary schools. As a result of these activities, all children

brush their teeth once a day or more and the mean DMFT score of Tongan children has significantly decreased as the program has become more established. Moreover, the MaliMali team promotes the MaliMali Program in the following ways: oral health festivals (offering dental examinations, toothbrushing guidance, and FMR), workshops for Tongans interested in dentistry and education, and publicity on TV, radio, and in newspapers. Moreover, fissure sealant treatment is offered year-round in the dental section of Vaiola Hospital. The South Pacific Medical Team and JICA in Japan handle the planning for the MaliMali Program; procure toothbrushes, fluoride toothpaste, fluoride, dental materials, other materials, and cars; and establish donation procedures for these materials. All of these activities decrease the incidence of caries among children in the Kingdom of Tonga.

The MaliMali Program is universally accepted in the society of the Kingdom of Tonga. The MaliMali Program has contributed to establishing toothbrushing as a habit among children and to decreasing the prevalence of caries by applying fluoride. However, the MaliMali Program cannot presently prevent early caries in baby teeth before entrance into kindergarten and primary school. Decreasing the prevalence of caries in baby teeth and immature permanent teeth is very important. Therefore, babies and toddlers should be included in the MaliMali Program and a new program of preventive dentistry should be formed for these children and their parents. Based on their experience up to 2009, in addition to the MaliMali Program, SPMT and JICA and the Ministry of Health of the Kingdom of Tonga established "The Project of Improving School-based Oral Health Activity in Kingdom of Tonga" in 2010. The aims of this project include manpower training, creating a manual of preventive dentistry, and decreasing caries in baby teeth and immature permanent teeth to improve the MaliMali Program. In addition, water fluoridation is recommended as a way to administer fluoride in developing countries (14, 15). However, because Tongans use rainwater stored in tanks at every household and facility, water fluoridation might be difficult. Salt fluoridation has therefore been proposed (16).

#### **Acknowledgments**

This investigation was supported by JICA Partnership Program from the Japan International Cooperation Agency, Japan. The authors wish to thank all the members of

MaliMali Team, the Ministry of Health, and the Ministry of Education, the Kingdom of Tonga.

## References

1. Ministry of Education, Culture, Sports, Science and Technology, supervised: *The Manual of Medical Examination for School Children*, Revised Edition, 2008, Japanese Society of School Health, Tokyo, Japan.
2. Kawamura K, Fifita S, Kuyama K, Taguchi C, Kawamura S, Shimizu J, Tomiki S, Kobayashi S, Yamamoto H: Preventive program for gingivitis of school children in the Kingdom of Tonga. *J Dent Hlth*, 54: 383, 2004.
3. Adachi M, Yamamoto T: A change of Tongan dietary habit into bread-centered from taro-centered. *Japan Dental Association*, 35: 31-38, 1982.
4. Yonemitsu M, Kobayashi S, Miyazaki H, Kawaguchi Y, Tsurumoto A, editors: *Contemporary Preventive Dentistry*, Fourth Edition, 2010, Ishiyaku Publishers, Inc., Tokyo, Japan.
5. Twetman S, Petersson L, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, Lingström P, Mejäre I, Nordenram G, Norlund A, Söder B: Caries-preventive effect of sodium fluoride mouth rinsings: a systemic review of controlled clinical trials. *Acta Odontol Scand*, 62: 223-230, 2004.
6. Fukai K, Nakamura S, Ogawa T, Tokunaga K, Yano H: Evaluation of fluoride mouth-rinsing program for schoolchildren in a developing country. *J Dent Hlth*, 49: 262-269, 1999.
7. Sköld UM, Petersson LG, Birkhed D, Norlund A: Cost-analysis of school-based fluoride varnish and fluoride rinsing programs. *Acta Odontol Scand*, 66: 286-292, 2008.
8. Fluorides and oral health. Report of a WHO Expert Committee on Oral Health Status and Fluoride Use. *World Health Organization Technical Report Series*, 846: 1-37, 1994.
9. Kobayashi S, Taguchi C, Arikawa K: Endeavor toward the healthy society with caries-free children. Spread the school-based fluoride mouthrinse program. *Jpn J Clinical Dentistry for Children*, 16: 47-52, 2011.
10. Chief of Health Policy Bureau and Health Service Bureau, Ministry of Health, Labour and Welfare: *The Guidelines for Fluoride Mouth Rinsing*, 2003.
11. Kobayashi S, Kishi H, Yoshihara A, Horii K, Tsutsui A, Himeno T, Horowitz AM: Treatment and posttreatment effects of fluoride mouthrinsing after 17 years. *J Public Health Dent*, 55: 229-233, 1995.
12. Morgan MV, Crowley SJ, Wright C: Economic evaluation of a pit and fissure dental sealant and fluoride mouthrinsing program in two nonfluoridated regions of Victoria, Australia. *J Public Health Dent*, 58: 19-27, 1998.
13. Murray JJ: *Appropriate use of fluorides for human health*, 1986, World Health Organization, Geneva, Switzerland.
14. Burt BA and Eklund SA: *Dentistry, Dental Practice, and the Community*, Sixth Edition, 2005, Elsevier Saunders, St. Louis, Missouri, USA.
15. Hargreaves JA: Water fluoridation and fluoride supplementation: considerations for the future. *J Dent Res*, 69: 765-770, 1990.
16. Estupinan-Day S: *Promoting Oral Health. The Use of Salt Fluoridation to Prevent Dental Caries*, 2005, Pan American Health Organization, Washington, DC, USA.