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2019 Laos children's dental caries experience survey

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Objectives: The aim of this study was to determine the dental caries experience of children in Laos. **Methods:** Oral examinations were performed on a total of 1,540 students in 513 primary school students, 537 middle school students, and 490 high school students and the results analyzed.

Results: The dft index (decayed-filled primary teeth index) of 6-year-old primary school children was 6.04. The DMFT index (decayed-filled-missing permanent teeth index) was 1.59 in 12-year-old middle school children and 2.04 in 15-year-old middle school children.

Conclusions: Caries experience in most of the age groups was on the high side. It is considered that in Laos, a treatment project to stop the progression of caries is necessary in parallel with a prevention project to lower the caries fatality rate.

Key Words: Dental caries, Dental health surveys, Laos

Introduction

Oral tissues such as teeth and periodontal tissues are the main factors determining satisfaction in social life. The two major oral diseases that destroy the health of the oral cavity are periodontal diseases called dental caries^{1,2}.

Dental caries mainly appear when patients are in elementary school and the incidence rate increases. Therefore, oral health management in the period of exchange from primary teeth to permanent teeth, called mixed dentition, should be treated more importantly. Notably, several factors interact with each other in the occurrence of such dental caries. The factors work by adding the time, the host, pathogen, and environment. Among them, environmental factors include social and geo-

graphic factors and access to dentistry¹⁻³. Social factors include public oral health programs and community-based oral health programs conducted to prevent dental caries¹⁻⁴.

The oral health project plans and oral health policies are established through the oral health survey and by statistically analyzing oral conditions. Several countries have attempted to investigate oral health status in their national programs⁵⁻⁷. This is because it is the basic information for establishing oral health plans in a country^{1,2}.

The World Health Organization (WHO) regularly collects data on cavities in most countries worldwide for publication, book publication, and book and data bank file formats^{3,4}. However, recent data on the incidence of caries in Laos have not been formally reported to the WHO, and efforts have been

made to investigate caries status in some areas⁸⁻¹³.

Laos (Lao People's Democratic Republic) is located in Southeast Asia and borders China, Myanmar, Vietnam, Cambodia, and Thailand. Laos is a landlocked country. In 2012, the population was estimated to be about 6,500,000¹³.

One-third of Laos's population lives below the international poverty line. Laos is one of the lowest-paying countries in the world and has a low-income economy. In 2013, Laos ranked 138th in the Human Development Index (HDI), showing a lack of media. According to the Global Hunger Index (2013), Laos is the worst regarding hunger situations and ranked as the 25th poorest country¹⁴⁻¹⁶.

There are about 500 dentists in Laos vs. the estimated 14,000 patients per capita. Additionally, there are 137 private dental clinics in Vientiane, the capital of Laos, and 38 private dental clinics in 16 other states¹⁷⁻¹⁹.

Therefore, the study analyzes the results of a survey on the dental caries experience of children in all regions of Laos for the implementation of the Lao government's public oral health project and uses it as basic data.

Materials and Methods

1. Subjects

This study was conducted with primary school students of 6 years, middle school students of 12 years, and high school students of 15 years from five regions in the northwest, northeast, central, south-central, and southern regions of Laos. Primary school, middle school, and high school were recommended by the Lao Dental Association and the Lao Office of Education (DKU IRB 2019-10-002) (Table 1).

Statistical sampling by geographic stratification was conducted in 5 provinces (one urban and one rural population in each province), including two provinces in the North (Luangprabang and Luangnamtha), two provinces in Central Lao (Vientiane and Savannakhet), and one province in the South (Champasak).

One urban and one rural population in each province.

① (Central) Vientiane province

② (South central) Savannakhet province

③ (Northern - northeast) Luangprabang province

④ (Northern - northwest) Louangnamtha province

⑤ (Southern) Champasak province

2. Methods

2.1. Composition of investigation team

The survey team consisted of 13 people, including seven Korean dentists, three Laos dentists, one examination assistant and recorder, and two administrative personnel. The survey team was trained just before the survey, and the survey standards among teams were made uniform.

2.2. Survey schedule

The investigation was conducted three times, and the schedule was as follows.

① (Southern) May, 2018 (2018.05.09.-2018.05.11.)

② (Northern) November, 2018 (2018.09.23.-2018.09.28.)

③ (Central) February, 2019 (2019.02.03.-2019.02.08.)

2.3. Survey criteria

The standards for oral examination were as follows²⁰⁻²².

0: Healthy teeth: Teeth with no ongoing caries lesions and no trace of ongoing treatment of caries.

1: Caries teeth: Teeth with lesions where softened hemorrhoids or free enamel are detected.

3: Experienced caries: A tooth filled with permanent filling material, a tooth that has no caries around the filling, and a tooth with an artificial crown due to caries.

4: Loss of caries experience: Permanent teeth removed due to caries, teeth replaced by processed dentures. However, the abutment of a processed denture is a non-experienced caries tooth.

5: Loss of caries non-experienced teeth: Permanent teeth lost due to causes other than caries (trauma, congenital encephalopathy, periodontal disease, orthodontic retrieval) and caries experienced teeth were not counted.

6: Dental fissure complete tooth: Tooth with groove filling.

7: Non-experienced caries teeth: Permanent teeth with ar-

Table 1. Age and gender distribution of study subjects

Age	Laos			Urban area			Rural area		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	1,540	640	899	761	322	439	778	318	460
6-year-old	513	234	279	249	113	136	264	121	143
12-year-old	537	229	307	275	119	156	261	110	151
15-year-old	490	177	313	237	90	147	253	87	166

tificial crowns or bands due to causes other than caries (trauma, aesthetic disorders, processed dentures, orthodontics for fixing devices) and caries-experienced teeth were not counted.

8: Non-erupted teeth.

9: Unrecordable teeth.

2.4. Statistics processing

After recording the oral examination results using the statistical program in EXCEL (Version 2019, Microsoft inc, USA), descriptive statistics were calculated using SPSS version 26.0.

Then, for the six-year-old children, the dft index (decayed-filled primary teeth index), dfs index (decayed-filled primary teeth surface index), df rate (primary tooth dental caries experience rate), dt rate (decayed primary teeth rate), and ft rate (filled primary teeth rate) were calculated.

Additionally, for the 12-year-old and 15-year-old children, the DMFT index (decayed-filled-missing permanent teeth index), DMFS index (decayed-filled-missing permanent teeth surface index), DMF rate (permanent tooth dental caries experience rate), DT rate (decayed permanent teeth rate), and FT rate (filled permanent teeth rate) were calculated.

Results

1. Primary tooth dental caries experience rate of primary school student (6-year-old)

Table 2 shows the primary tooth dental caries experience rate of the six-year-old children in Laos.

2. Permanent tooth dental caries experience rate of middle school student (12-year-old)

Table 3 shows the permanent tooth dental caries experience rate of 12-year-old children in Laos.

3. Permanent tooth dental caries experience rate of high school student (15-year-old)

Table 4 shows the permanent tooth dental caries experience rate of 15-year-old children in Laos.

Discussion

Tooth decay, or dental caries, is an organic component, occurring when various microorganisms present in the oral cavity decompose remaining sugars after food intake. The acid generated from the process results in the destruction of the calcium components among the mineral components of the teeth, exposing them to disease and decay. This dental caries is a chronic, widespread disease that does not recover the tooth to

Table 2. Laos primary school students' caries experience

Index	Value	Laos			Urban area			Rural area		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
st	Mean	11.11	11.18	11.05	10.69	10.42	10.91	11.50	11.88	11.18
	SD	4.99	4.90	5.08	4.99	5.01	4.98	4.98	4.70	5.19
dt	Mean	6.01	5.94	6.06	6.17	6.47	5.93	5.85	5.45	6.19
	SD	4.00	4.07	3.94	3.92	4.11	3.74	4.08	3.99	4.13
ft	Mean	0.03	0.05	0.01	0.03	0.06	0.01	0.02	0.03	0.01
	SD	0.30	0.43	0.10	0.39	0.57	0.09	0.17	0.22	0.12
dft	Mean	6.04	5.99	6.07	6.20	6.53	5.93	5.88	5.49	6.20
	SD	4.00	4.06	3.95	3.90	4.07	3.75	4.08	4.00	4.13
ds	Mean	13.44	13.22	13.62	14.18	14.81	13.66	12.74	11.74	13.59
	SD	12.42	12.34	12.51	12.39	12.90	11.98	12.44	11.65	13.05
fs	Mean	0.07	0.15	0.01	0.13	0.27	0.01	0.02	0.03	0.01
	SD	1.18	1.74	0.10	1.68	2.49	0.09	0.17	0.22	0.12
dfs	Mean	13.51	13.37	13.63	14.31	15.08	13.67	12.77	11.78	13.60
	SD	12.44	12.36	12.52	12.41	12.91	11.99	12.44	11.66	13.04
df rate	%	91.62	92.74	90.68	91.16	92.92	89.71	92.05	92.56	91.61
dt rate	%	99.55	99.22	99.82	99.48	99.05	99.88	99.61	99.40	99.77
ft rate	%	0.45	0.78	0.18	0.52	0.95	0.12	0.39	0.60	0.23

st, number of sound primary teeth; dt, number of decayed primary teeth; ft, number of filled primary teeth for dental caries; dft, number of primary teeth with caries experience; ds, number of decayed primary teeth surface; fs, number of filled primary teeth surface for dental caries; dfs, number of primary teeth surface with caries experience; df rate, primary tooth dental caries experience rate; dt rate, decayed primary teeth rate; ft rate, filled primary teeth rate.

Table 3. Laos middle school students' permanent teeth dental caries experience

Index	Value	Laos			Urban area			Rural area		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
ST	Mean	22.67	22.79	22.59	22.83	23.16	22.58	22.51	22.39	22.60
	SD	4.42	4.32	4.51	4.19	3.80	4.45	4.67	4.81	4.58
DT	Mean	1.45	1.26	1.58	1.53	1.40	1.63	1.35	1.10	1.53
	SD	1.99	1.77	2.13	2.02	1.81	2.17	1.96	1.73	2.10
FT	Mean	0.07	0.06	0.08	0.11	0.08	0.13	0.04	0.05	0.03
	SD	0.38	0.29	0.43	0.43	0.30	0.51	0.31	0.28	0.34
MT	Mean	0.07	0.05	0.08	0.08	0.05	0.10	0.06	0.05	0.07
	SD	0.34	0.31	0.37	0.37	0.31	0.41	0.31	0.30	0.32
IT	Mean	0.14	0.13	0.16	0.15	0.12	0.17	0.14	0.14	0.14
	SD	0.51	0.47	0.53	0.51	0.42	0.57	0.51	0.53	0.49
DMFT	Mean	1.59	1.37	1.75	1.72	1.53	1.87	1.45	1.20	1.63
	SD	2.07	1.85	2.21	2.05	1.82	2.21	2.08	1.88	2.20
DS	Mean	2.52	2.19	2.74	2.60	2.36	2.79	2.40	2.01	2.69
	SD	4.07	3.73	4.29	4.12	3.52	4.53	4.01	3.96	4.04
FS	Mean	0.11	0.10	0.12	0.18	0.14	0.21	0.04	0.05	0.04
	SD	0.58	0.50	0.64	0.73	0.64	0.79	0.36	0.28	0.41
MS	Mean	0.34	0.26	0.41	0.38	0.25	0.48	0.31	0.27	0.33
	SD	1.71	1.53	1.83	1.85	1.57	2.03	1.55	1.49	1.60
DMFS	Mean	2.97	2.55	3.27	3.16	2.76	3.47	2.75	2.33	3.06
	SD	4.60	4.23	4.83	4.53	3.80	5.01	4.66	4.66	4.66
DMF rate	%	53.92	50.66	56.35	58.91	56.30	60.90	48.66	44.55	51.66
DT rate	%	90.99	91.72	90.50	89.22	91.76	87.63	93.12	91.67	93.90
FT rate	%	4.68	4.46	4.84	6.34	4.95	7.22	2.65	3.79	2.03
MT rate	%	4.33	3.82	4.66	4.44	3.30	5.15	4.23	4.55	4.07
Mortal rate	%	14.04	13.38	14.53	13.95	11.54	15.46	14.29	15.91	13.41

ST, number of sound permanent teeth; DT, number of decayed permanent teeth; FT, number of filled permanent teeth for dental caries; MT, number of missing permanent teeth for dental caries; IT, number of permanent teeth required for extraction; DMFT, number of permanent teeth with caries experience; DS, number of decayed permanent teeth surface; FS, number of filled permanent teeth surface for dental caries; MS, number of missing permanent teeth surface for dental caries; DMFS, number of permanent teeth surface with caries experience; DMF rate, permanent tooth dental caries experience rate; DT rate, decayed permanent teeth rate; FT rate, filled permanent teeth rate; MT rate, missing permanent teeth rate; Mortal rate, caries fatality rate.

its original state and becomes progressive throughout life¹⁻⁴.

Such dental caries occur frequently in elementary school students, the transition time from primary teeth to permanent teeth. Therefore, the prevention of dental caries applied during this period can be effective in promoting oral health.

The two major oral diseases are dental caries and periodontal diseases. The age when primary and permanent teeth are exchanged, the primary school period, is important as this is when the foundation for lifelong oral health is established⁴.

The nationwide dental caries experience data is key to understand the state of caries among the public. It becomes the basic data for establishing oral health policies. Laos is a landlocked Southeast Asian country bordered by Myanmar and the People's Republic of China to the northwest, Vietnam to the east, Cambodia to the south, and Thailand to the west. In 2012, the population was estimated to be about 6.5 million²³⁻²⁶.

Laos is divided into 17 provinces, including the capital city of Vientiane. In this survey, there were five target regions, including

Luangnamtha Province in the northwest, Luangprabang Province in the northeast, Vientiane Province in the central region, Savannakhet Province in the south-central region, and Champasak Province in the south. The study participants were six-year-old primary school students, 12-year-old high school students, and 15-year-old high school students from each region. Oral examinations were conducted, and results were analyzed to create basic data for implementing public oral health projects in Laos.

The author analyzed the results of oral examinations of 1,540 students, including samples from 513 primary, 537 middle, and 490 high school students to confirm the dental caries experiences of children in Laos.

In six-year old primary school children, the dft index was 6.04, the dfs index was 13.51, the df rate was 91.62%, the dt rate was 99.55%, and the ft rate was 0.45%.

Among the 12-year-old middle school children, the DMFT index was 1.59, the DMFS index was 2.97, the DMF rate was 53.92%, the DT rate was 90.99%, the FT rate was 4.68%, and the

Table 4. Laos high school students' permanent teeth dental caries experience

Index	Value	Laos			Urban area			Rural area		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
ST	Mean	26.03	26.18	25.95	25.70	25.97	25.54	26.34	26.40	26.31
	SD	3.01	3.05	3.00	3.30	3.28	3.31	2.69	2.78	2.65
DT	Mean	1.71	1.63	1.75	1.84	1.72	1.91	1.58	1.53	1.61
	SD	2.63	2.71	2.58	2.92	2.87	2.96	2.32	2.55	2.19
FT	Mean	0.23	0.20	0.25	0.35	0.33	0.36	0.12	0.06	0.15
	SD	0.89	0.84	0.92	1.12	1.13	1.12	0.59	0.28	0.69
MT	Mean	0.10	0.07	0.12	0.18	0.10	0.22	0.03	0.05	0.02
	SD	0.43	0.28	0.49	0.57	0.34	0.67	0.20	0.21	0.19
IT	Mean	0.20	0.16	0.22	0.24	0.17	0.28	0.17	0.15	0.17
	SD	0.64	0.50	0.71	0.73	0.48	0.84	0.55	0.52	0.57
DMFT	Mean	2.04	1.90	2.12	2.37	2.16	2.50	1.74	1.63	1.79
	SD	2.85	2.90	2.82	3.19	3.13	3.24	2.45	2.64	2.35
DS	Mean	3.16	3.05	3.21	3.53	3.28	3.69	2.80	2.82	2.80
	SD	5.39	5.50	5.34	6.19	5.96	6.34	4.50	5.00	4.24
FS	Mean	0.31	0.27	0.33	0.46	0.47	0.46	0.16	0.07	0.20
	SD	1.24	1.24	1.24	1.60	1.68	1.56	0.71	0.33	0.84
MS	Mean	0.51	0.36	0.59	0.88	0.49	1.12	0.16	0.23	0.12
	SD	2.13	1.40	2.45	2.84	1.66	3.35	0.98	1.05	0.95
DMFS	Mean	3.97	3.68	4.13	4.88	4.23	5.27	3.12	3.11	3.12
	SD	6.06	5.82	6.19	7.07	6.26	7.51	4.78	5.30	4.51
DMF rate	%	57.14	53.67	59.11	60.34	60.00	60.54	54.15	47.13	57.83
DT rate	%	83.70	85.71	82.68	77.72	79.90	76.57	91.34	93.66	90.24
FT rate	%	11.30	10.42	11.75	14.80	15.46	14.44	6.83	3.52	8.42
MT rate	%	5.00	3.87	5.57	7.49	4.64	8.99	1.82	2.82	1.35
Mortal rate	%	15.50	12.50	17.02	18.72	12.89	21.80	11.39	11.97	11.11

ST, number of sound permanent teeth; DT, number of decayed permanent teeth; FT, number of filled permanent teeth for dental caries; MT, number of missing permanent teeth for dental caries; IT, number of permanent teeth required for extraction; DMFT, number of permanent teeth with caries experience; DS, number of decayed permanent teeth surface; FS, number of filled permanent teeth surface for dental caries; MS, number of missing permanent teeth surface for dental caries; DMFS, number of permanent teeth surface with caries experience; DMF rate, permanent tooth dental caries experience rate; DT rate, decayed permanent teeth rate; FT rate, filled permanent teeth rate; MT rate, missing permanent teeth rate; Mortal rate, caries fatality rate.

caries fatality rate was 14.04%.

Among the 15-year-old high school children, the DMFT index was 2.04, the DMFS index was 3.97, the DMF rate was 57.14%, the DT rate was 83.7%, the FT rate was 11.3%, and the caries fatality rate was 15.5%.

Comparing urban and rural areas, the dft index of six-year-old children was 6.20 in cities and 5.88 in rural areas, and the DMFT index of 12-year-old children was 1.72 in cities and 1.45 in rural areas. In these cases, the survey showed a DMFT of 2.37 in cities and 1.74 in rural areas, indicating that the caries experience was higher among children in urban areas.

In the gender comparison, the dft index of six-year-old children was 5.99 for males and 6.07 for females, and the DMFT index for 12-year-old children was 1.37 for males and 1.75 for females. The survey results showed a DMFT of 2.12 in rural areas and that the female children had high caries experience in both primary and permanent teeth, with large differences in permanent teeth.

Dental caries experience in most age groups was high. Especially the DMF rate was as high as 90.99% in 12-year-old children and 83.70% in 15-year-old children. The dt rate was also at a very high level of 99.55%. The caries fatality rate was 15%. Therefore in Laos, there was a need for treatment projects to stop the progression of caries and lower the caries fatality rate, simultaneously executing prevention projects.

The number of teeth treated with dental pit and fissure sealant is an average of 0.01 per subject, and there are almost no students who received dental pit and fissure sealant. Therefore, expansion of the dental pit and fissure sealant program is also necessary.

Laos is an underdeveloped country receiving international support. The proportion of the access to dental treatment costs to income level is inferior. It once promoted development through the introduction of a market economy in a communist country. Laos has only one dental college, and the number of oral health assistants who are members of dental care is insuf-

ficient. For the qualitative growth of dental care, it is necessary to predict the appropriate manpower that meets the needs of the people and make efforts to produce them through medical education above a certain level.

Conclusion

The authors analyzed the results of oral examinations for 1,540 students in 513 primary school students, 537 middle school students, and 490 high school students to confirm the dental caries experiences of children in Laos.

1. The dft index of six-year-old primary school children was 6.04, the dfs index was 13.51, the df rate was 91.62%, the dt rate was 99.55%, and the ft rate was 0.45%.

2. The DMFT index of 12-year-old middle school children was 1.59, the DMFS index was 2.97, the DMF rate was 53.92%, the DT rate was 90.99%, FT rate was 4.68%, and the caries fatality rate was 14.04%.

3. The DMFT index of 15-year-old middle school children was 2.04, the DMFS index was 3.97, the DMF rate was 57.14%, the DT rate was 11.3%, and the caries fatality rate was 15.5%.

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