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Mass treatment of head louse infestation with Sumithrin powder in primary schools in Korea

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Abstract: A mass treatment of head louse infestation with Sumithrin® powder (0.4% phenothrin) in primary school children was implemented during the period of September 1991-May 1992. The infestation rate of total 2,515 children was 38.6% in average (21.2% in boys and 57.2% in girls). The reduction rate of head louse infestation was 93.4% with a single treatment and 94.8% with double consecutive treatments with about 10 days interval, which indicated that a single treatment would be recommended for the mass treatment in the community. Long term follow-up after Sumithrin powder application for head louse control in a primary school showed that the infestation rate dropped from 33.1% before treatment to 5.4% by seven months after treatment, giving a 83.4% reduction rate.

Key words: Mass treatment, Sumithrin® powder, head louse, Korea.

INTRODUCTION

The head louse, *Pediculus humanus capitis*, is a bloodsucking insect parasite which lives on the hair and scalp of man. Although not proven to be vectors of louse-borne diseases, head lice infestations are intensely uncomfortable sometimes accompanied by secondary infection or hypersensitive reactions that can be of medical as well as social importance.

Recent reports revealed that school-age children in Korea are heavily infested with head lice. The infestation rate was 44.5% among 5,937 school children of Yongyang-gun, Kyongsangbuk-do (Kim *et al.*, 1984), and 73.5% (452 positives among 615 children) at Sosan-gun, Chungchongnam-do (Lee *et al.*, 1984). Pai and Huh (1987) reported a 91.9% infestation rate among 386 school children at Munkyong-gun, Kyongsangbuk-do. Pai *et al.* (1989a) examined 11,865 school children for head louse infestation and reported a 14.4% positive rate in urban areas and 58.9% in rural areas, and also 14.4% in middle schools and 31.3% in primary schools.

Although it is apparent that such high infestations with head lice are of public health importance and the delousing campaign at the community levels are urgently required, few efforts have been made for the establishment of effective control measures, and any single insecticide formulation for louse control is not available in Korea. Upon such a public requirement, the field trial on control effect of Sumithrin powder against head lice were carried out during the period of September 1991-May 1992.

MATERIALS AND METHODS

Four primary schools were selected for this trial: (1) Ilsin Primary School, Inchon, (2) Paju Primary School, Paju-gun, Kyonggi-do, (3) Hajom Primary School, Kangwha-gun,

Kyonggi-do and (4) Awha Primary School, Kyongju-shi, Kyongsangbuk-do. Control effect of a single treatment was studied in Awha Primary School, of double treatment in Ilsin Primary School and Paju Primary School, and of both single and double treatments in Hajom Primary School.

The tested pediculicide was Sumithrin® powder, which is a registered product for human louse treatment, manufactured by Sumitomo Chemical Co., Ltd. Japan, and contains 0.4% phenothrin. Phenothrin is one of the synthetic pyrethroids which has low mammalian toxicity and high insecticidal activity. The chemical name is 3-phenoxybenzel d-cis trans-chrysant hemate. WHO(1988) selected phenothrin as one of candidate insecticides for human louse control and reported that LC_{50} to human lice was 0.05%.

The school children were examined for head louse infestation by checking the presence of viable eggs(nits), which were confirmed by a hand lens and/or a stereomicroscope when doubtful. All of positive children were treated with Sumithrin powder. The second treatment was done to all the previously treated children by 10~12 days after the first treatment, and the negative children were left untreated. The amount of 1.3~1.5 g powder per child was applied on scalp in the morning, by using a plastic bottle-made duster and the children were asked to wash off their scalps when they got back home, so that at least one to several hours were exposed to the chemical. For evaluation of control effect all the school children were rechecked whether viable eggs were present after 20~24 days of the first and/or second treatment. The eggs found from the treated children were carefully observed under a stereomicroscope whether the eggs were viable or dead. Viable eggs are shiny and spherical in shape, not wrinkled, nor flat. One or two classes of each school were left untreated for control. For the evaluation of long term effect of Sumithrin powder application for head louse control, the pupils of Paju Primary School who were treated twice with 14 days intervals in November 1991 were reexamined for head louse infestation in May 1992, seven months after treatment.

RESULT

The infestation rates of the school children were 40.5% at Ilsin Primary School (Inchon city), 33.1% at Paju Primary School (Paju-gun), 39.2% at Hajom Primary School (Kangwha-gun) and 43.6% at Awha Primary School (Kyongju shi), giving a 38.6% infestation rate in average as shown in Table 1. The infestation rate of girls was significantly higher than that of boys, giving 55.1% in girls whereas 21.2% in boys ($p<0.05$).

The control effect of Sumithrin powder against head lice were satisfactory not only with double treatments but with a single treatment. The reduction rate of head louse infestation among school children by the mass treatment of Sumithrin powder were in average 93.4% by 20~22 days after a single treatment, being 89.6% at Hajom Primary School and 95.2% at Awha Primary School as shown in Table 2, whereas the infestation rate of the control group increased from 54.7% to 55.8%. The control effect of double treatments of Sumithrin powder against head lice with 10~12 days intervals are shown in Table 3. The reduction rate was 94.8% in average by 22~24 days after the second treatment, being 93.1% at Ilsin Primary School, 92.1% at Hajom Primary School and 97.7% at Paju Primary School. The infestation rate of head lice in the control group showed 4.1% increase (from 38.8% to 42.9%).

All the pupils of Paju Primary School were re-examined for head louse infestation in May 1992 by 7 months after the second treatment and the result is given in Table 4. The overall infestation rate of the children was 5.4%(41 positive children), which was slightly increased compared to a 2.0% infestation rate by one month after the second treatment (in November 1991). It was, however, remarkably low com-

Table 1. Head louse infestation rates of four primary school children in September-October 1991

Name of primary school	Grade	Male		Female		Total	
		No.	Pos.(%)	No.	Pos.(%)	No.	Pos.(%)
Ilsin (Inchon)	1	99	19	103	61	202	80(39.6)
	2	141	21	118	74	259	95(36.7)
	3	144	20	129	90	273	110(40.3)
	4	144	27	131	97	275	124(45.1)
	Total	528	87(16.5)	481	322(66.9)	1009	409(40.5)
Paju (Paju-gun)	Kin.*	13	1	17	7	30	8(26.7)
	1	57	15	54	26	111	41(36.9)
	2	66	20	57	29	123	49(39.8)
	3	64	9	57	30	121	39(32.2)
	4	88	14	61	27	149	41(27.5)
	5	59	5	68	29	127	34(26.8)
	6	63	11	74	41	137	52(38.0)
	Total	410	75(18.3)	388	89(48.7)	798	264(33.1)
Hajom(Kangwha-gun)	Kin.*	15	6	9	2	24	8(33.3)
	1	11	4	18	7	29	11(37.9)
	2	11	4	19	12	30	16(53.3)
	3	13	1	11	5	24	6(25.0)
	4	20	7	20	13	40	20(50.0)
	5	24	8	15	6	39	14(35.9)
	6	1	2	17	8	31	10(32.3)
	Total	108	32(29.6)	109	53(48.6)	217	85(39.2)
Awha(Kyongju-shi)	Kin.*	30	4	25	9	55	13(23.6)
	1	19	10	21	12	40	22(55.0)
	2	27	7	32	10	59	17(28.8)
	3	30	15	35	17	65	32(49.2)
	4	42	16	44	31	86	47(54.7)
	5	46	12	38	20	84	32(38.1)
	6	54	16	48	35	102	51(50.0)
	Total	248	80(32.3)	243	134(55.1)	491	214(43.6)
Grand total		1294	274(21.2)	1221	698(57.2)	2515	972(38.6)

* Kin.: Kindergarten

Table 2. Control effect of a single treatment of Sumithrin power against head lice in primary schools

Name of primary school	Treated group			Control group	
	No. pos. before treatment	No. pos. after treatment	Reduction rate (%)	No. pos.(%) before treatment	No. pos.(%) after treatment
Hajom	77	8	89.6	—	—
Awha	167	8	95.2	47(54.7)	48(55.8)
Total	244	16	93.4	—	—

Table 3. Control effect of double treatments of Sumithrin powder against head lice in primary schools

Name of primary school	Treated group			Control group	
	No. pos. before treatment	No. pos. after treatment	Reduction rate (%)	No. pos.(%) before treatment	No. pos.(%) after treatment
Ilsin	346	24	93.1	121(40.5)	129(44.2)
Hajom	76	6	92.1	31(32.3)	39(38.5)
Paju	264	6	97.7	—	—
Total	686	36	94.8	152(38.8)	168(42.9)

pared to a 33.1% infestation rate of the pre-treatment, showing a 83.7% reduction rate after seven months of the treatment, whereas the reduction rate by one month after treatment was 94.0%. Among 41 infested children after seven months of the treatment, 10 pupils were either newly enrolled in March 1992 or transfered from other schools after treatment, and the remaining 31 were previously examined ones, of which 22 children(71.0%) had been infested before the treatment and 9 children(29.0%) were newly infested after the treatment. This fact indicates that main sources of re-infestation were not from school mates but from family members of the children. Therefore, it is recommended that one month after a pediculicide application the re-infested pupils should be treated again and their families also should be treated together for keeping better long-term effect.

Table 4. Long-term follow-up of head louse infestation rate in Paju Primary School after 7 months of Sumithrin powder treatment*

Grade	Pre-treatment(10 Oct. 1991)						
	Male		Female		Total		%
	No.	Pos.	No.	Pos.	No.	Pos.	
Kind.	13	1	17	7	30	8	26.7
1	57	15	54	26	111	41	36.9
2	66	20	57	29	123	49	39.8
3	64	9	57	30	121	39	32.2
4	88	14	61	27	149	41	27.5
5	59	5	68	29	127	34	26.8
6	63	11	74	41	137	52	38.0
Total	410	75	388	189	798	264	—
%	—	18.5	—	48.7	—	—	33.1
R.R.**	—	—	—	—	—	—	—

Grade	1 month after treatment(12 Nov. 1991)						
	Male		Female		Total		%
	No.	Pos.	No.	Pos.	No.	Pos.	
Kind.	12	0	17	1	29	1	3.4
1	59	0	54	1	113	1	0.9
2	66	0	58	4	124	4	3.2
3	64	1	57	3	121	4	3.3
4	87	1	59	2	146	3	2.1
5	59	0	67	1	126	1	0.8
6	63	1	75	1	138	2	1.4
Total	410	3	387	13	797	16	—
%	—	0.7	—	3.4	—	—	2.0
R.R.**	—	—	—	—	—	—	94.0

Grade	7 months after treatment(8 May 1992)						
	Male		Female		Total		%
	No.	Pos.	No.	Pos.	No.	Pos.	
Kind.	10	0	17	0	27	0	0
1	54	2	59	4	113	6	5.4
2	60	2	54	5	114	7	6.1
3	59	0	64	5	123	5	4.1
4	63	0	58	7	121	7	5.8
5	80	2	58	6	138	8	5.8
6	59	0	69	8	128	8	6.3
Total	385	6	379	35	764	41	—
%	—	1.6	—	9.2	—	—	5.4
R.R.**	—	—	—	—	—	—	83.7

* Sumithrin powder was applied to the positive children immediately after examination of head louse infestation on 10 October 1991.

** R.R.: Reduction rate(%) of head louse infestation.

DISCUSSION

A 93.4% reduction rate of head louse infestation after a single treatment of Sumithrin powder was unexpectedly high. This result

strongly implicates the fact that phenothrin has the powerful ovicidal effect, otherwise such high reduction rate would not be expected, because all positive children had viable eggs (nits); if most of the eggs are not killed, they would hatch within 7 days and newly hatched nymphs would grow to adults by 7~9 days. The result that there was no significant difference in control effect between a single application and double applications (93.4% versus 94.8% of reduction rate) also supports the ovicidal effect of this insecticide. A laboratory study is required for finding out how strong ovicidal effect 0.4% phenothrin powder has.

In general, mass treatment of chemicals among school children can hardly expect a complete success in operation. In this respect, a 94.8% control rate after double treatments with Sumithrin powder can be said excellent. Taplin *et al.* (1986) evaluated the pediculicidal efficacy of 1% permethrin creme rinse (NIX®) and 1% lindane shampoo (Kwell®) and resulted that 96.6% (28 out of 29 treated) and 43.3% (13 out of 30 treated) respectively were free of lice by 14 days after treatment. Urcuyo and Zaias (1986) applied 0.5% malathion lotion on 61 head louse infested children and reported 90.2% of reduction rate (6 out of 61 treated) by 24 hours after treatment. Pai *et al.* (1989b) reported that a 87.1% reduction rate was shown in an orphanage at Chomchon-up three months after double treatments of 0.2% permethrin solution. Park *et al.* (1991) also evaluated control effect of 0.1% permethrin solution against head louse infestation in a primary school, and reported that a 65.8% infestation rate (75 out of 114) before treatment reduced to 26.3% (30 out of 114) by three months after double treatments to all the pupils including negatives, showing 60% of reduction rate. Pai *et al.* (1991) compared 24% benzylbenzoate solution with 0.2% permethrin solution for head louse control in primary schools and reported that three months after the second treatment, the reduction rate was 87.9% in the 24% benzylbenzoate treated group (76.7% infestation rate before treatment and 9.3% after treatment), whereas it was 72.3% in the 0.2% permethrin treated group (68.3% before and 18.9% after treatment). The result of our trial with 0.4% phenothrin powder was better than those results obtained by other workers mentioned above. The best formulation for mass treatment is dust(powder), because this is much fast and easily applied (WHO, 1985), and safer in human toxicity(WHO, 1978).

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=국문초록=

국민학교 아동을 대상으로 한 스미스린 0.4% 분제의 머릿니 집단구제 효과

연세대학교 열대의학연구소
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국내 4개 국민학교를 선정하여 머릿니 기생률을 조사한 결과 총 2,515명의 아동 중 972명이 양성으로 평균 38.6%의 기생률을 보였다. 이들 양성자에게 0.4% 훼노스린 분제(Sumithrin® powder)를 집단 처리하여 머릿니 구제효과를 조사하였다. 1회 처리시의 구제율은 93.4%이었고, 약 10일 간격으로 2회 처리시의 구제율은 94.8%이었다. 1회와 2회 처리시의 구제율에 있어 유의성을 찾아볼 수 없기 때문에, 집단처리 할 때는 1회 살포로 구제가 가능하다고 생각된다. 훼노스린 분제 처리 7개월 후의 머릿니 기생률이 5.4%로서 처리 전의 33.1%에 비해 83.4%의 감소율을 보였다.

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