Original

Comparison of periodontal health status and oral health behavior between Japanese and Chinese dental students

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Abstract: A survey was carried out to compare periodontal health status and oral health behavior between Japanese and Chinese dental students. Subjects consisted of 118 students at Nihon University School of Dentistry and 92 students at the school of Stomatology, Nanjing Medical University. Saliva occult blood test was performed to classify whether subjects may have periodontal disease. Further questionnaires were given to evaluate different lifestyles and oral hygiene habit. The positive rate of the saliva occult blood test in Japanese dental students was 13.6％, and that of Chinese dental students was 43.5％. Bleeding from gingiva as a subjective symptom was as follows: Japansese 7.6％, Chinese 37.0％. Japanese dental students brushed for 13.5 min each day. The rate for Chinese students was 4.6 min. Use of interdental devices was as follows: Japanese 33.1％, Chinese 7.6％. Differences of periodontal disease rates between Japanese and Chinese dental students are thought to be differences in oral hygiene, indicating the need for improvements in hygiene measures in Nanjing City. The establishment and strengthening of oral hygiene education, including the importance of tooth brushing for prevention of periodontal disease, has been proposed. (J Oral Sci 51, 275-281, 2009)

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Introduction

Recently, China is accomplishing remarkable development through rapid modernization. However, Gini's coefficient in China is 0.45 which is about 0.2 point higher than that of Japan (World Development Indicators Database 2005). This shows differences in wealth are still intense and that problems in society may still exist in China. In terms of public health, the average life span in China has been greatly extended from 35 years in 1949 to 71 years in 2000 (Cao, 2003). However, the number of dentists in China per population is about 1/30 of that in Japan, and people's poor dental health may be due to few specialists (Hasegawa and Cao, 2004). For example, the rate of periodontal disease in 12 year old children is 69%. From a survey of Peking University School of Stomatology in 1986, 44% of tooth extraction (1st place) is due to periodontal disease. Periodontal disease is highly prevalent in China but periodontists are few (Cao, 2003). Several surveys also indicated that Chinese children and adults frequently have gingival bleeding and calculus, and the establishment of school-based oral health promotion together with general health promotion is urgently required (1-4). To implement an effective program for prevention of periodontal disease, it may be necessary to investigate the background of people's lifestyles, including oral hygiene, and to analyze the relationship between those elements and the prevalence of periodontal disease.

The understanding of the School of Stomatology, Nanjing Medical University has been obtained, and a base for joint research concerning the saliva test and questionnaires has been established. As a first step, this joint research investigated rates of periodontal disease in the saliva occult blood test (Perioscreen "Sunstar") and examined the lifestyle including the oral hygiene by self-administered structured questionnaires, and compared the results from students of the Department of Dentistry at Nihon University School of Dentistry and the school of Stomatology, Nanjing Medical University.

Subjects and Methods

Subjects

Subjects consisted of students from Nihon University School of Dentistry (Japanese dental students) and students from the School of Stomatology, Nanjing Medical University (Chinese dental students). This research was approved by the Ethics Committee of both dental schools. The objectives were explained to all participants both orally and in writing. Approval was also obtained, in the same way, from the Chinese side.

Saliva occult blood test

Saliva occult blood test was carried out using a novel test paper strip coated with anti-human hemoglobin monoclonal antibody for detection of occult blood in
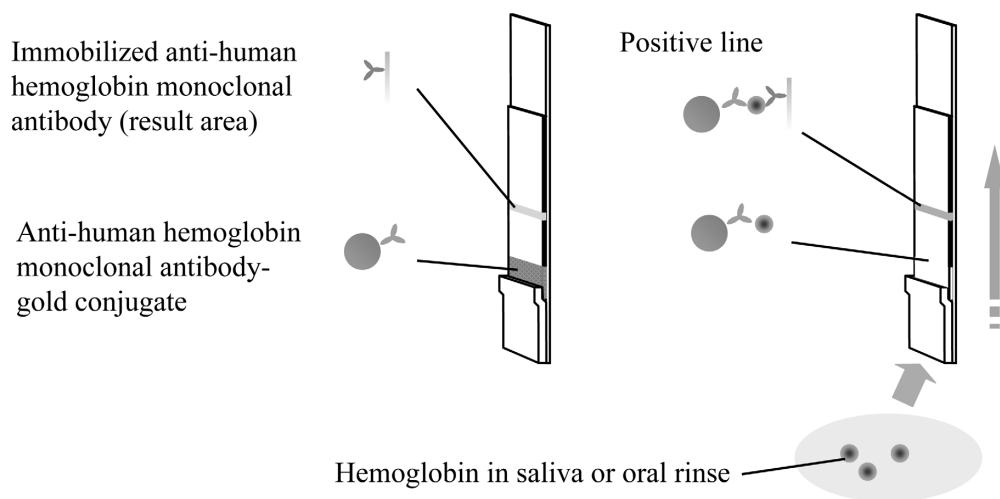

Fig. 1 Diagram of immunochromatographic strip and assay principle of Perioscreen "Sunstar". The testing part at the bottom side of the testing strip is dipped into the sample solution (mouth rinse or diluted saliva). Anti-human hemoglobin monoclonal antibody (mouse) combined with colloidal gold starts to dissolve and an immunocomplex with hemoglobin in the sample solution appears. The immunocomplex moves on the developing part by capillary action. Anti-human hemoglobin monoclonal capture antibody (mouse) immobilized at the upper portion of the strip (result area) catches the immunocomplex and the red-violet line appears. Developing time is around 5 minutes. The red-violet (positive) line is detected when 2 µg/ml or more human hemoglobin is included.

saliva (Perioscreen "Sunstar", Figs. 1 and 2). The membrane was precoated with human hemoglobin specific antibody (capture antibody) on the result area. During the test, the specimen is allowed to react with the anti-human hemoglobin monoclonal antibody-colloidal gold conjugate which was pre-dried on the lower portion of the test strip. The mixture then moves upward on the membrane chromatographically by the capillary action. For a positive specimen, the conjugate binds to the human hemoglobin forming an antigen-antibody complex. This complex binds to the anti-human hemoglobin antibody as a captured reagent on the result area and produces a red-violet colored band (positive line) when human hemoglobin concentration is equal to or greater than 2 μg/ml (Figs. 1 and 2). Absence of this colored band in the result area suggests a negative result.

Each subject was instructed to put 3 ml of water into the mouth and rinse for 10 s. The mouth rinse sample was obtained by exhalation it into a paper cup. The tail of Perioscreen was put into the sample liquid (oral rinse) for around 5 min to rise of the liquid, and then, the result was observed. With reference to the manufacturer's manual, results were assessed as positive (++, +) or negative (±, −), by dentists at Nihon University School of Dentistry or the School of Stomatology, Nanjing Medical University, respectively.

Questionnaires

Questionnaires written in Japanese to examine the lifestyle and the oral hygiene habits were kindly provided by Prof. Koichi Ito (Department of Periodontology, Nihon University School of Dentistry). The same questionnaires were translated into Chinese and used in the School of Stomatology, Nanjing Medical University. Information was obtained about the age, sex, medical history, experience of dental treatment, subjective symptoms, oral habits, meal, eating habits consumption of alcohol and tobacco, oral hygiene habits, and other factors (Table 1). The time required to complete the questionnaires was about 5 minutes.

Statistics

The relationship between the results obtained in the questionnaires and the saliva occult blood test was examined using Chi square (χ^2) test or Student t-test.

Results

Valid responses from the questionnaires completed by the volunteer students in Nihon University School of Dentistry were 118, and average age of responders was 22.1 year. At the School of Stomatology, Nanjing Medical University, 92 questionnaires were obtained and the average age was 22.1 years. The difference in ages between the two groups was not significant ($P > 0.05$, t-test).

Table 2 shows the results of saliva occult blood test (Perioscreen) and questionnaires. When comparing the results, Japanese students positive rate was only 13.6% whereas that of Chinese students was 43.5%, indicating a high positive rate for Chinese students.

Some major differences between Japanese and Chinese students were found from the results of questionnaires as shown in Table 2. Results of the survey showed 10.2% of Japanese reported having a medical history, including infectious diseases, the rate for Chinese students was 34.8%. A total of 88.1% of Japanese students reported experience of dental treatment, whereas the figure for Chinese students was 51.1%. The survey found that 18.6% of Japanese students had undergone orthodontic treatment,
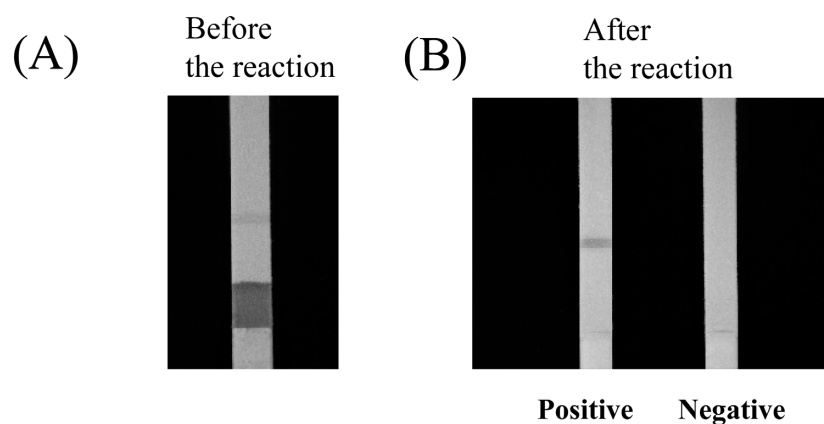

Fig. 2　Diagram of positive line and negative result. (A) Before the reaction, the result line is in light blue. (B) After the reaction, red-violet colored band will appear at the result line if the sample contained 2 μg/ml or more of human hemoglobin (left, positive). If the sample contained no human hemoglobin, the band will not appear (right, negative).

Table 1 A summarized version of the health questionnaires used in this study

1. Gender (Male, Female)
2. Age (___)
3. General medical history
   Have you ever suffered from a serious illness? (Yes, No)
   If yes, put circle(s). (Otolaryngeal disease, Gastrointestinal disease, Liver disease, Kidney disease, Pancreatic disease, Serum hepatitis, Pneumonia, Tuberculosis, Cholecystitis, Rheumatism, Psychosis, Cancer, Blood disease, Cardiovascular disease, Hypertension, Hypotension, Anemia, Asthma, Allergy, Diabetes, Epilepsy, Syphilis, Gonorrhea, Tumor, Others_____)
4. Are you allergic to any drugs or foods? (Yes, No)
   If yes, which drug or food? (_____)
5. Are you taking any medications? (Yes, No)
   If yes, which ones? (_____)
6. Are you currently receiving treatment at a hospital? (Yes, No)
   If yes, which disease? (_____)
7. Do you have physical checkups regularly? (Yes, No)
   If yes, when? (_____)
8. Have you ever been diagnosed with a disease as a result of a physical check up? (Yes, No)
   If yes, what kind of disorders? (_____)
9. Have you ever experienced a serious pain in the head and neck, face, or temporomandibular joint? (Yes, No)
10. Have you ever been experienced dental treatment? (Yes, No)
    If yes, put circle(s). (Tooth decay, Tooth extraction, Orthodontic treatment, Crown or Denture, Gum or periodontal disease)
11. Have you ever experienced continuous bleeding after tooth extraction or injury? (Yes, No)
12. Have you experienced the following? If yes, put circle(s). (Tickled gum, Pain in gum, Swollen gums, Bleeding gums, Pus discharge from gums, Sticky mouth, Bad breath, Loose teeth, Irregular teeth, Difficult to bite hard foods, Food impaction, Teeth sensitive to cold or hot water, Grinding or clenching teeth, Habit of biting such as nail or pencil, Habit of biting such as tongue, cheek, or lip, Breathing through your mouth, Others_____)
13. Do you have unbalanced diet? (Yes, No)
    If yes, what kind of foods do you like (_____), or do you dislike? (_____)
14. Do you like soft foods rather than hard one? (Yes, No)
15. Do you like vegetables and fruits? (Yes, No)
16. Do you like sweets such as chocolates or cakes? (Yes, No)
17. Do you like to drink coffee or black tea? (Yes, No) (____ cups a day)
18. Do you like to drink carbonated drinks? (Yes, No) (____ bottles a day)
19. Do you smoke? (Yes, No) (____ cigarettes a day)
20. Do you like alcoholic drinks? (Yes, No)
    If yes, what kind of drink and how much drink? (_____, ___ bottles or glasses a day)
21. Frequency and time of teeth brushing? (___ times a day, ___ minutes/time)
22. Your tooth brush is made of (Nylon, Animal hair, Others_____).
23. Do you use tooth paste? (Yes, No)
    If yes, what name? (_____)
24. Do you massage your gums? (Yes, No)
25. Do you use dental floss or interdental brush? (Yes, No)
26. Do you use tooth picks? (Yes, No)
27. Do you use disclosing agent? (Yes, No)
28. Do you use electric oral rinse device? (Yes, No)
29. Do you use mouth rinse solution? (Yes, No) If yes, what name? (_____)

whereas in Chinese students it was only 4.4%.

Concerning the gingival conditions, 37.0% of Chinese students showed gingival bleeding whereas the figure for Japanese students was 7.6%. The percentage who felt pain in the gingiva was 1.7% in Japanese students, whereas it was 12.0% in Chinese students. Furthermore, 3.3% of Chinese students had a pus discharge from their gingiva. In Chinese students, 2.2% reported not being able to chew

Table 2 Results of questionnaires

	Total No.	Perioscreen positivity	General medical history	allergy	Pain in the head and neck, face, or temporomandibular joint	Health conditions (good)	Dental treatment experience	Reasons for previous dental treatment				
								Tooth decay	Tooth extraction	Orthodontic treatment	Gums or Periodontal disease	Crown or Denture
Japan	118	16	12	6	5	99	104	97	61	22	4	21
(%)		13.6	10	5.8	4.2	83.9	88.1	82.2	51.7	18.6	3.4	17.8
China	92	40	32	12	6	88	47	32	26	4	5	2
(%)		43.5	34.8	13.0	6.5	95.7	51.1	34.8	28.3	4.3	5.4	2.2
P value		1.15E-06	1.37E-05	0.00409	0.461	0.00681	3.09E-09	1.248E-12	6.25E-04	0.00180	0.468	3.22E-04

	Total No.	Status of the present gums					Status of the present mouth and teeth						Habits of the mouth	
		Tickled gum	Pain in gum	Swollen gums	Bleeding gums	Pus discharge from gums	Sticky mouth	Bad breath	Loose teeth	Difficult to bite hard foods	Food impaction	Teeth sensitive to cold or hot water	Grinding or clenching teeth	Habit of biting such as tongue, cheek, or lip
Japan	118	6	2	6	9	0	9	2	2	0	29	10	25	11
(%)		5.1	1.7	5.1	7.6	0	7.6	1.7	1.7	0	24.6	8.5	21.2	9.3
China	92	0	11	14	34	3	0	4	1	2	37	10	12	5
(%)		0	12.0	15.2	37.0	3.3	0	4.3	1.1	2.2	40.2	10.9	13.0	5.4
P value		0.0282	0.0022	0.0131	1.73E-07	0.0481	0.00678	0.252	0.712	0.108	0.0154	0.557	0.124	0.292

	Total No.	Habits of the mouth		Nonessential groceries				Oral care						
		Breathing through your mouth	Habit of biting such as nail or pencil	Having sweets	Drinking alcholic drinks	Smoking	Average toothbrushing time (min/day)	Use of a nylon toothbrush	Use of a tooth-brushing agent	Massage your gums	Use of interdental devices	Use of toothpick	Use of an electric oral rinse device	Use of a mouth rines solution
Japan	118	11	5	72	35	32	13.5	98	103	26	39	18	2	14
(%)		9.3	4.2	61.0	29.7	27.1		94.1	87.3	22.0	33.1	15.3	1.7	11.9
China	92	10	3	59	0	2	4.6	91	91	0	7	10	0	1
(%)		10.9	3.3	64.1	0	2.2		98.9	98.9	0	7.6	10.9	0	1.1
P value		0.711	0.714	0.644	1.05E-08	1.12E-06	3.91E-20 (t-test)	1.44E-05	0.00163	1.51E-06	9.74E-06	0.354	0.210	0.00262

P values were calculated using Chi-square test.

Table 3 Odds ratios between Perioscreen positive Chinese students and several items in the questionnaire (Chi square test)

	Status of the present gums			Status of the present mouth and teeth				Habits of the mouth				Oral care	
	Pain in gum	Swollen gums	Bleeding gums	Bad breath	Loose teeth	Food impaction	Teeth sensitive to cold or hot water	Grinding or clenching teeth	Habit of biting such as tongue, cheek, or lip	Breathing through your mounth	Habit of biting such as nail or pencil	Use of interdental devices	Use of toothpick
Odds ratio	7.20*	3.83*	2.73*	1.46	0.909	1.31	1.91	0.657	0.342	1.47	0.00	1.08	0.952

*: $P < 0.05$

hard foods. The rate of smoking, one of the risk factors for periodontal disease, was much higher (27.1%) in Japanese students and much lower in Chinese students (2.2%). Incidence of grinding or clenching teeth were higher in Japanese students (21.2%) than in Chinese students (13.0%). As for oral hygiene habits, the average time spent brushing a day for Japanese students was longer (13.5 min) than that in Chinese students (4.6 min). The interdental devices such as interdental brush or dental floss were used by 33.1% of Japanese students and 7.6% of Chinese students.

Chi square test between Perioscreen positive person and each item in the questionnaire revealed that the significant correlations existed in gingival pain, gingival swelling, and gingival bleeding ($P < 0.05$) in Chinese students. Their odds ratios were 7.2 for gingival pain, 3.8 for gingival swelling, and 2.7 for gingival bleeding, respectively. In Japanese students, there was no significant correlations because of a much lower Perioscreen positive rate.

Discussion

The first step in a joint research program between Japan and China was based on the difference in lifestyles in order to assess oral disease status using a combination of saliva occult blood test (Perioscreen) and a questionnaire. This research focused on periodontal disease which is known to have high rates in Japan. The study used a saliva occult blood test together with a questionnaire for subjects who were Japanese and Chinese dental students.

Perioscreen "Sunstar" is a novel test paper strip to detect occult blood in saliva or in mouth rinse using specific

antibody to human hemoglobin for screening of periodontal disease; it has both high sensitivity and high specificity (> 90%) (7) and was jointly-developed by Nihon University and Godo Shusei. In this study, it was not possible to carry out individual dental examinations. Accordingly, Perioscreen positive subjects were considered to be affected by periodontal disease such as gingivitis or periodontitis. The test results of Perioscreen revealed that Chinese students showed a high positive rate of 43.5% compared with Japanese students. This high positive rate corresponds to that found in people aged 35-40 years old in a Japanese survey. Since the subjects in this study were dental students, it could be concluded that periodontal disease in Chinese people starts at an early age. In fact, it has been reported that the periodontal disease rates in 1995 were 69% in 12-year olds, 78.4% in 15-year olds and 85.2% in 18 year-olds in China (Cao, 2003). Accordingly, examination of periodontal disease status not only in the students, but also in all age groups including infants may be required in the near future in China.

From the results of the questionnaire, the necessity for improving the public health including oral hygiene in China has been suggested, since 34.8% had medical history and several subjects had history of infectious disease.

Concerning the experience of dental treatment, half of the Chinese students answered that they had no experience of dental treatment. However, taking into account that China has 1/30 of the number of dentists compared to Japan, those Chinese students who had experienced dental treatment may represent a much higher rate compared to that of the average person. In any event, Chinese people do not visit dental clinics regularly. The higher rate of periodontal disease found in young subjects in China is considered to be linked to infrequent visits to dental clinics and lack of brushing instructions.

Concerning the oral status, the ratio of symptoms of gingiva such as pain, swelling, and bleeding was higher in Chinese students. From the results of Chi square test, it has been suggested that a person having one of the above-mentioned three symptoms in the gingiva should visit a periodontist, since that person has a high risk of periodontal disease. In Stomatological Hospital of Nanjing Medical University (Stomatological Hospital of Jiangsu Province), although there were many patients at the Implant Clinic, there were few patients in the Periodontal Department, suggesting a bias towards oral hygiene consciousness in local populations in Nanjing City. Accordingly, it is necessary to examine the relationship between social health and welfare systems, and the environment of dental services in order to develop higher levels of oral hygiene in Chinese populations.

Concerning oral care habits, the brushing time of Japanese students was three times longer than that of Chinese students. In the present questionnaire, there was no item that covered the history of tooth brushing instruction. Therefore, it is not clear how the difference originated. Although it may be considered that the levels of knowledge of students in Stomatological College of Nanjing Medical University may be high, the Chinese people have little chance to recognize the "Importance of brushing". Furthermore, there is no system of dental hygienists and no educational institution for dental hygienists in China, and this may result in less chance for people to recognize the "Importance of brushing" and to avoid dental disease, including periodontal disease.

From the results of present survey, it is clear that the recognition of the "Importance of oral hygiene" in the prevention of dental caries and periodontal disease should be a priority for Chinese students, particularly as they bear a responsibility for the oral hygiene of China in the future. Furthermore, greater efforts are required to improve the levels of public health through the increased education for oral hygiene (8,9).

To accomplish the above aims in the face of a lack of dentists and to reduce oral disease within 10 or 20 years, it seems important to stress that prevention is necessary, since this may result in the most cost-effective results.

Accordingly, it is important to start a campaign so that people recognize that tooth loss as you get older is not a natural phenomenon, but actually a kind of sickness. The present study should act as a motivating factor for oral hygiene habit-making for dental students in both Japan and China.

Acknowledgments

References

1. Wang HY, Petersen PE, Bian JY, Zhang BX (2002) The second national survey of oral health status of children and adults in China. Int Dent J 52, 283-290.
2. Zhu L, Petersen PE, Wang HY, Bian JY, Zhang BX (2003) Oral health knowledge, attitudes and behaviour of children and adolescents in China. Int Dent J 53, 289-298.

3. Jiang H, Petersen PE, Peng B, Tai B, Bian Z (2005) Self-assessed dental health, oral health practices, and general health behaviors in Chinese urban adolescents. Acta Odontol Scand 63, 343-352.

4. Lin HC, Schwarz E (2001) Oral health and dental care in modern-day China. Community Dent Oral Epidemiol 29, 319-328.

5. Ohshima M, Suzuki K, Eda M, Sato M, Ito K, Murai S, Otsuka K (1997) An immunological test using anti-human hemoglobin monoclonal antibody for detection of occult blood in saliva – comparison with the peroxidase method. Nippon Shishubyo Gakkai Kaishi 39, 273-280. (in Japanese)

6. Ohshima M, Fujikawa K, Ariizumi M, Shin Z, Suzuki K, Yoshinuma N, Eda M, Ito K, Murai S, Otsuka K (1998) Evaluation of a screening test for periodontal disease using anti-human hemoglobin monoclonal antibody to detect occult blood in saliva – comparison with the clinical parameters. Nippon Shishubyo Gakkai Kaishi 40, 111-118. (in Japanese)

7. Ohshima M, Fujikawa K, Kumagai K, Idesawa M, Ezawa S, Ito K, Otsuka K (2001) Evaluation of a novel test paper strip method for detecting occult blood in saliva as a screening test of periodontal disease. Nippon Shishubyo Gakkai Kaishi 43, 416-423. (in Japanese)

8. Choo A, Delac DM, Messer LB (2001) Oral hygiene measures and promotion: review and considerations. Aust Dent J 46, 166-173.

9. Petersen PE (2009) Global policy for improvement of oral health in the 21st century – implications to oral health research of World Health Assembly 2007, World Health Organization. Community Dent Oral Epidemiol 27, 1-8.