Oral and Radiographic Findings in Patients Undergoing Continuous Ambulatory Peritoneal Dialysis

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Objective: *To compare the oral status, cortical and spongy bone density of the mandible, and dental pulp calcification between the patients undergoing continuous ambulatory peritoneal dialysis (CAPD) and age- and sex-matched healthy controls.*
Material and Method: *Thirteen end stage renal disease patients undergoing CAPD and 17 age- and sex- matched healthy volunteers were enrolled. The questionnaires, oral radiography, and intraoral examination, including number of decayed teeth, filled teeth, missing teeth, plaque index, gingival index, calculus index, and oral hygiene index were performed in both groups. Two views of oral radiology, comprising panoramic and bite-wing radiographs, were taken to evaluate mandibular bone density and pulp calcification. The data were analyzed with t-test and Mann-Whitney U tests.*
Results: *Both groups were similar in baseline demographics, including age, sex, and education. Plaque index, calculus index, and oral hygiene index of the CAPD patients were significantly worse than the controls' (p = 0.025, 0.015, and 0.014, respectively). Percentage of decayed teeth and missing teeth of the CAPD patients had a trend to be higher than control. The percentage of filled teeth, decayed missing filling tooth (DMFT) index, sum of percentage DMFT, gingival index, average of spongy and cortical bone densities, and the percentage of pulp calcification were comparable in both groups.*
Conclusion: *CAPD had poorer oral hygiene than the healthy; however, DMFT, pulp calcification, and bone density were not differenct from the healthy. This urges the medical personnel to examine all CAPD patients in order to prevent hematogenous spreading of occult oral infection.*

Keywords: *Oral status, Dental hygiene, DMFT, Spongy bone density, CAPD*

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The oral manifestations of end stage renal disease (ESRD) patients consist of pale oral mucasa, bleeding disorders, bad taste, hyposalivation, and uremic stomatitis[1-5]. Teeth and jaw bone defects are also mentioned in the literatures as follows: delayed eruption of permanent teeth, enamel hypoplasia of deciduous and permanent teeth, pulp obliteration, pulp calcification, and renal osteodystrophy (ROD)[5-12]. The characteristic radiography of jaw bone in the patients with ROD are bone demineralization, decreased trabeculation, decrease thickness of cortical bone, radiolucent fibrocystic lesions, and brown tumor[5,7,13-15]. In addition, the oral hygiene of hemodialysis patients is also poor when compared with the general population, with greater gingivitis, caries and plaque, and calculus formations[2,16-20].

Nowadays the number of CAPD patients is rapidly increasing. It is inevitable that dentists will have chance to take care of these patients. The dental care of CAPD patients can be complicated by the presentation of comorbid conditions such as diabetes and hypertension. On the other hand, dental caries and periodontal diseases may cause tremendous problem to patients as the infection may spread to the peritoneum causing peritonitis. However, no one has seriously explored the prevalence of oral and dental

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changes in the PD patients Therefore, a study of the oral health of CAPD patients was undertaken to observe oral lesions and determine the dental health status. Moreover, the radiography was additionally taken to detect pulp stone or pulp obliteration and to calculate the bone density of cortical and spongy bones.

Material and Method

CAPD patients from Banphaeo Hospital (Prommitr Branch) and King Chulalongkorn Memorial Hospital and 17 healthy volunteers (the control) were recruited. The controls and CAPD patients were age and gender matched. All of the participants were informed about the details of the present study that was approved from the IRB, Chulalongkorn University and signed in the consent form.

The participants answered the questionnaire about their general information such as gender, age, occupation, socioeconomic status, and their oral care behavior. Medical and dental histories were recorded. The oral examination, including number of decayed teeth, missing teeth, and filled teeth (DMFT index) together with oral and mucosal alterations were taken by one experienced dentist in order to validate the technique of examination. The examinations were performed in both of the posterior and anterior portions of the dentition. In the posterior portion of the dentition, the first fully erupted tooth distal to the second bicuspid, usually the first molar but sometimes the second or third molar, was examined. The buccal surfaces of the selected upper molars and the lingual surfaces of the selected lower molars were inspected. In the anterior portion of the mouth, the labial surfaces of the upper right and the lower left central incisors were scored. In the absence of either of these anterior teeth, the central incisor on the opposite side of the midline was substituted. The clinical oral variables included: (a) plaque index (PI); (b) gingival index (GI); (c) calculus index; (d) oral hygiene index[21].

The participants with posterior teeth were taken panoramic radiography with 10 x 12 inch film and recorded the average density (gray scale value) of cortical and spongy bones that presented by DELL and evaluated by INFINIT. The investigation of impacted teeth for analyzing DMFT index was also included. Moreover, the 4 bite-wing films per case operated at 75 kVp, 15 mA for 0.18 s with Kodak insight no.2 to obtain the information of posterior teeth in 4 quadrants was performed. The number of teeth and pulp calcification defined by pulpal sclerosis and pulp stone were recorded. The films were analyzed with clinical blind by oral radiologist. Statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS) version 13.0 in that Mann Whitney U test, t-test, Chi-square Test and Kruskal Wallis Test were used where appropriate.

Results

There were 30 participants consisting of 13 CAPD patients and 17 healthy controls. As expected, no differences in gender and age between both groups was detected. Nearly CAPD patients had co-morbid diseases, for example, hypertension (69.2%), diabetes mellitus (61.5%), bone and joint disease (15.4%), cardiovascular disease (15.4%), and dylipidemia (8.3%). Most of the participants had educational status lower than bachelor's degree which were comparable between both groups. The numbers of patients that had salary less than 10,000 baht in the CAPD patients (76.92%) were slightly, but not significantly, higher than the control (56.25%) (Table 1).

CAPD patients had significantly poorer oral hygiene compared to the control as indicated by higher average plaque index (CAPD = 2.12 ± 0.62, control = 1.66 ± 0.45, $p = 0.025$), average calculus index (CAPD = 2.05 ± 0.64, control = 1.47 ± 0.59, $p = 0.015$), and oral hygiene index average (CAPD = 4.16 ± 1.20, control = 3.12 ± 0.99, $p = 0.014$) (Fig. 1). However, no differences in the numbers of the remaining and defected (decayed, extracted, and filled) teeth were observed. Both groups were similar in DMFT and gingival indexes. Density of cortical and spongy bones and pulpal calcification of both groups were not statistically different ($p = 0.132$, 0.154, and 0.814, respectively) (Table 2).

In addition, CAPD patients had more commonly observed abnormal changes in the oral soft tissue, including petechiae (23.1%), coated tongue (15.4%), and mucosal pallor (7.7%) (Fig. 2).

Regarding the behavior data, most of the CAPD patients brushed their teeth less than twice a day (53.85%) while none of the control group did ($p = 0.003$). Fortunately, none of the participants in both groups forgot brushing. However, most of the patients brushed only 1-2 minutes and all of them never used dental floss and mouthwash for additional cleansing. The majority of the participants sought the dentist's advice only when the problems existed. One third of the CAPD patients never had oral examination or dental treatment, while 29.4% of the control group reported receiving regular oral examination from the dentist (Table 3). Of interest, CAPD patient (61.54%) had sweets more than thrice a week while 29.41% of the

Table 1. Characteristics of the end state renal disease patients undergoing continuous ambulatory peritoneal dialysis (CAPD) and the control subjects

	CAPD (n = 13)	Control (n = 17)	p-value
Gender			
Male	10 (76.9%)	11 (64.7%)	0.469
Female	3 (23.1%)	6 (35.3%)	
Age			
< 30 years	1 (7.7%)	0 (0.0%)	0.298
30-50 years	7 (53.9%)	13 (76.5%)	
> 50 years	5 (38.5%)	4 (23.5%)	
Education			
Non-university graduate	10 (76.9%)	10 (58.8%)	0.297
Bachelor's degree or higher	3 (23.1%)	7 (41.2%)	
Income			
< 10,000 bahts	10 (76.9%)	9 (56.3%)	0.244
> 10,000 bahts	3 (23.1%)	7 (43.8%)	

Table 2. Data evaluated from intraoral examination and radiographs of the end state renal disease patient undergoing continuous ambulatory peritoneal dialysis (CAPD) compared to the control subjects (mean ± SD)

	Mean ± SD		p-value
	CAPD (n = 13)	Control (n = 17)	
Number of teeth	25.54 ± 6.56	27.76 ± 3.8	0.563
Percentage of decayed teeth	21.79 ± 23.67	17.15 ± 20.28	0.592
Percentage of missing teeth	20.20 ± 20.47	13.24 ± 11.88	0.563
Percentage of filled teeth	3.95 ± 5.81	17.49 ± 23.14	0.065
DMFT index	12.46 ± 8.61	13.24 ± 8.95	0.813
Sum of percentage DMFT	45.94 ± 37.46	47.87 ± 35.63	0.886
Plaque index	2.12 ± 0.62	1.66 ± 0.45	0.025*
Calculus index	2.05 ± 0.64	1.47 ± 0.59	0.015*
Oral hygiene index	4.16 ± 1.20	3.12 ± 0.99	0.014*
Gingival index	1.88 ± 0.47	1.58 ± 0.51	0.113
Cortical bone density (grayscale value)	114.35 ± 14.84	122.39 ± 13.43	0.132
Spongy bone density (grayscale value)	110.64 ± 16.96	119.57 ± 16.24	0.154
Percentage of pulp calcification	17.33 ± 24.06	15.06 ± 19.84	0.814

* Statically significant at 95% confidence level

control did. The controls also had 2-3 meals per day and had soft drink less than 3 times a week.

Discussion

The results of the present study demonstrated that plaque, calculus, and oral hygiene indexes of the CAPD patients were greater than the control (Table 2), indicating an inadequate oral hygiene care. In addition, one third of the CAPD patients never had oral examination or dental treatment. Most of the CAPD patients brushed their teeth less than twice a day while none of the control did once daily or did not brush. These observations were in accordance with previous studies in hemodialysis patients[17-19]. However, other habits representing poor hygiene, including floss use, numbers of dental visit and meal, frequencies of drinking soft drink and having sweet desserts, were not statistically significant between both groups (Table 3). The abnormal changes of oral cavity in the CAPD patients might be the direct effect from CKD or dialysis

Fig. 1 The oral hygiene of the control (top) and the CAPD patients (bottom). Poor oral hygiene with generalized dental plaque and calculus were frequently observed in CAPD patients

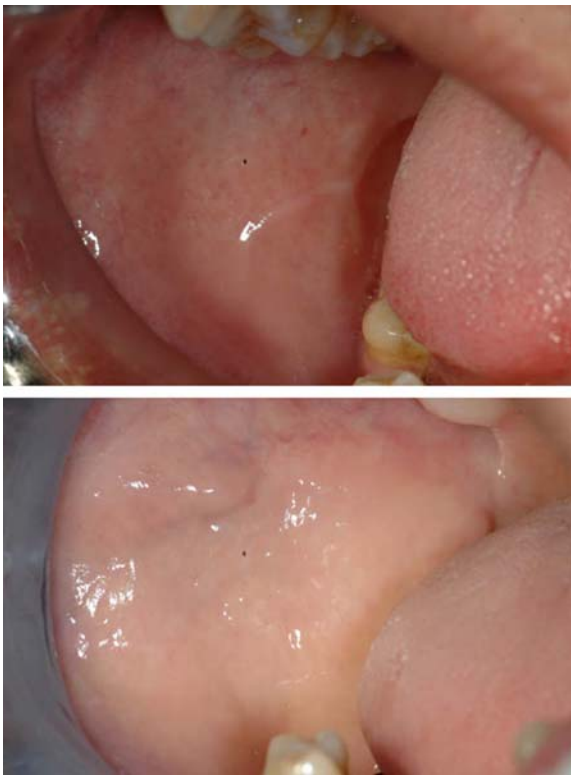

Fig. 2 Normal mucosa of the control subject (top) compared with pale oral mucosa of the CAPD patients (bottom)

related factors which were not included in the present study. Although the numbers of defect teeth in the CAPD patients were not different from the control, a trend of higher percentages of decayed teeth and missing teeth in the CAPD patients was observed (Table 2). These observations concurred with an earlier study[19]. The lower concerns of the oral hygiene might relate to the level of education and family income (76.9% had family income less than 10,000 bahts). The effect of secondary hyperparathyroidism on teeth and jaw bone in ESRD patients may not be much since there were no differences in cortical and sponge bone densities and pulp calcification between groups (Table 2). However, most of the CAPD patients participating in the present study suffered from ESRD less 3 years and received PD for a short period (1-6 months). The duration of ESRD may not be long enough to allow the disease affecting the mandibular bone density and dental pulp. However, the CAPD patients seemed to have narrower pulp chamber and higher pulp calcification than the control. Another limitation of this study is low number of participants; as such the results might not represent the whole CAPD patients.

In conclusion, plaque index, calculus index, and oral hygiene index of the CAPD patients were significantly greater than the control group, indicating poorer oral hygiene. Thus, the PD patients should receive periodically dental examinations to early detect oral defects and eliminate occult infection. The collaboration between the nephrologist and dentist is important to improve the oral health of the CAPD patients.

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Table 3. Oral health care, eating habits, and frequency of dental visits

	CAPD (n = 13)	Control (n = 17)	p-value
Brushing frequency			
Once daily	7 (53.85%)	0 (0.00%)	0.003*
Twice daily	6 (46.15%)	15 (93.75%)	
More than twice daily	0 (0.00%)	1 (6.25%)	
Frequency of forgetting to brush			
Regularly	1 (7.69%)	0 (0.00%)	0.430
Sometimes	4 (30.77%)	4 (23.53%)	
Never	8 (61.54%)	13 (76.47%)	
Brushing time			
1-2 minutes	6 (50.00%)	7 (43.75%)	0.773
2-3 minutes	3 (25.00%)	6 (37.50%)	
More than 3 minutes	3 (25.00%)	3 (18.75%)	
Flossing frequency			
Never	7 (58.33%)	7 (43.75%)	0.276
Occasionally	5 (41.67%)	6 (37.50%)	
More than once	0 (0.00%)	3 (18.75%)	
Mouthwash			
Do not use	9 (69.23%)	9 (60.00%)	0.611
Use	4 (30.77%)	6 (40.00%)	
Meals per day			
2-3 times daily	8 (66.67%)	12 (70.59%)	0.882
4-6 times daily	4 (33.33%)	5 (29.41%)	
Frequency of eating desert and sweets			
< Thrice weekly	5 (38.46%)	12 (70.59%)	0.078
> Thrice weekly	8 (61.54%)	5 (29.41%)	
Frequency of drinking soft drinks			
< Thrice weekly	12 (92.31%)	16 (94.12%)	0.844
> Thrice weekly	1 (7.69%)	1 (5.88%)	
Frequency of dental visits			
Never	4 (30.77%)	2 (11.76%)	0.215
Only with problems	8 (61.54%)	10 (58.82%)	
Regularly	1 (7.69%)	5 (29.41%)	

* Significant difference at 95% confidence level

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Potential conflict of interest

None.

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สภาวะช่องปากและภาพรังสีในผู้ป่วยที่ได้รับการล้างไตทางช่องท้อง

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วัตถุประสงค์*: เพื่อเปรียบเทียบความแตกต่างสภาวะช่องปาก มวลกระดูกทึบและกระดูกโปร่งของขากรรไกรล่าง และการมีแคลเซียมพอกพูนในโพรงประสาทฟันของผู้ป่วยที่ได้รับการล้างไตทางช่องท้องกับคนปกติ*

วัสดุและวิธีการ*: ผู้ป่วยไตวายเรื้อรังระยะสุดท้ายที่ได้รับการล้างไตทางช่องท้องจำนวน 13 คน และอาสาสมัครที่ไม่มีโรคประจำตัว มีอายุและเพศใกล้เคียงกัน จำนวน 17 คน เข้าร่วมการศึกษา โดยตอบแบบสอบถามและรับการตรวจสภาพในช่องปาก เพื่อบันทึกจำนวนฟันที่ผุ อุดและถอน บันทึกดัชนีคราบจุลินทรีย์ ดัชนีสภาพเหงือก ดัชนีหินน้ำลาย และดัชนีอนามัยช่องปาก พร้อมทั้งถ่ายภาพรังสีปริทัศน์และแบบกัดปีกเพื่อศึกษามวลกระดูก และการมีแคลเซียมพอกพูนในโพรงประสาทฟัน วิเคราะห์ข้อมูลทางสถิติด้วยการทดสอบแบบ สติวเดนท์-ที และแมนวิทนีย์ ยูเทสท์*

ผลการศึกษา*: ข้อมูลพื้นฐานของประชากรทั้งสองกลุ่มไม่มีความแตกต่างกันทั้งอายุ เพศและการศึกษา พบว่าค่าดัชนีคราบจุลินทรีย์ ดัชนีหินน้ำลายและดัชนีอนามัยช่องปากของกลุ่มผู้ป่วยที่ได้รับการล้างไตทางช่องท้องแย่กว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ (p = 0.025, 0.015, 0.014, ตามลำดับ) การศึกษาร้อยละจำนวนฟันผุ และฟันถอนของกลุ่มผู้ป่วยที่ได้รับการล้างไตทางช่องท้องมีแนวโน้มสูงกว่ากลุ่มควบคุม แต่ไม่พบความแตกต่างกันอย่างมีนัยสำคัญทางสถิติของร้อยละจำนวนฟันที่ถูกอุด ดัชนีฟันผุถอนอุด (DMFT) ร้อยละดัชนีฟันผุถอนอุด ดัชนีสภาพเหงือก ค่าเฉลี่ยมวลกระดูกโปร่งและกระดูกทึบ และร้อยละการเกิดแคลเซียมพอกพูนในโพรงประสาทฟัน*

สรุป*: ผู้ป่วยที่ได้รับการล้างไตทางช่องท้องมีอนามัยช่องปากที่แย่กว่าคนปกติ แต่ดัชนีฟันผุถอนอุด (DMFT) การเกิดแคลเซียมพอกพูนในโพรงประสาทฟันและความหนาแน่นของมวลกระดูกไม่มีความแตกต่างกับคนปกติ จากการศึกษานี้กระตุ้นให้บุคลากรทางการแพทย์ควรตรวจช่องปากผู้ป่วยที่ได้รับการบำบัดทดแทนไตทางช่องท้อง เพื่อกำจัดแหล่งติดเชื้อในช่องปากมิให้แพร่กระจายไปสู่ร่างกายบริเวณอื่น*