壁報論文比賽

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Cusp-replacement Adhesive CAD/CAM Ceramic Premolar Restoration Examination Using Acoustic Emission under Dynamic Load Testing

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Abstract

This study investigates CAD/CAM ceramic cusp-replacing restoration resistance with and without buccal cusp replacement under static and dynamic cyclic loads, monitored using the acoustic emission (AE) technique. The cavity was designed in a typical MODP (mesial-occlusal-distal-palatal) restoration failure shape when the palatal cusp has been lost. Two ceramic restorations [without coverage (WOC) and with (WC) buccal cuspal coverage with 2.0 mm reduction in cuspal height] were prepared to perform the fracture and fatigue tests with normal (200N) and high (600N) occlusal forces. The load versus AE signals in the fracture and fatigue tests were recorded to evaluate the restored tooth failure resistance. The results showed that non-significant differences of load value in the fracture test and the accumulated number of AE signals under normal occlusal force (200N) in fatigue test were found between with and without buccal cuspal coverage restorations. The first AE activity occurring for the WOC restoration was lower than that for the WC restoration in the fracture test. The number of AE signals increased with the cyclic load number. The accumulated number of AE signals for the WOC restoration was 187, higher than that (85) for the WC restoration under 600N in the fatigue test. The AE technique and fatigue tests employed in this study were used as an assessment tool to evaluate the resistances in large CAD/CAM ceramic restorations. Non-significant differences in the tested fracture loads and accumulated number of AE signals under normal occlusal force (200N) between different restorations indicated that aggressive treatment (with coverage preparation) in palatal cusp-replacing ceramic premolar require more attention for preserving and protecting the remaining tooth.

Keywords: *Cuspal-coverage, ceramic, acoustic emission, fatigue, CAD/CAM*

Introduction

With the advances in adhesive methods and ceramic materials, esthetic, metal-free restorations have led to the development of computer design/manufacturing (CAD/CAM) systems for fabricating ceramic inlays, onlays and veneers. CAD/CAM system generated ceramics are currently available that provide a novel means of restoring large cavities in posterior teeth, achieving chair-side design and automated production of

all-ceramic monolithic single-unit restorations. Structural loss with complete cusp fracture in a posterior tooth accompanied by a failed Class II MOD (mesial-occlusal-distal) restoration is a common phenomenon in dental practice. This study applied the AE (acoustic emission) technique to monitor the resistance in CAD/CAM ceramic restorations with and without buccal cusp replacement under static and dynamic cyclic loads. AE signal results at different cyclic load stages were obtained to understand the biomechanical response of premolar ceramic cuspal-replacing restorations.

Methods

Sample preparation

The cavity was designed in a typical MODP (mesial-occlusal-distal- palatal) (Fig. 1a and 1b). Two cavity types with 9 teeth in each group were prepared with palatal cusp-replacing ceramic restorations without (WOC) and with (WC) buccal cuspal coverage (Fig. 1b and 1c).

Both the WOC and WC onlay ceramic restorations were designed using the CEREC 3D CAD/CAM unit (Sirona Dental Systems) and machined from ProCAD Lucite-reinforced ceramic blocks (200, I14; Ivoclar Vivadent).

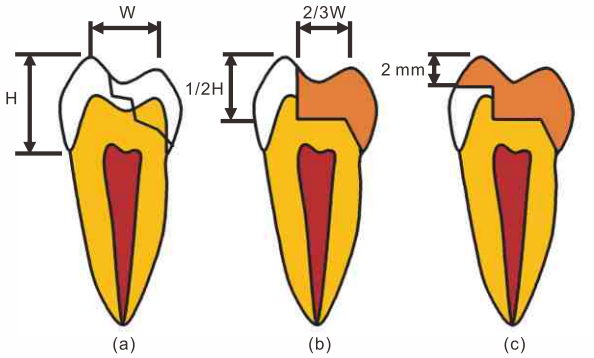

Fig.1 (a) Intact premolar with typical MODP (mesial-occlusal-distal- palatal); i.e., loss of a functional cusp with a 45-degree bevel surface at the cervical margin; (b) Maxillary premolar with palatal cusp fracture without buccal coverage preparation (WOC); (c) Maxillary premolar with palatal cusp fracture with buccal cusp reduced in 2mm height (WC).

Fracture and fatigue tests

Three samples from the WOC and WC groups were randomly selected and mounted vertically to the long tooth axis for fixation in a universal testing machine (E3000, Instron, Canton, MA, USA). The crosshead speed was set at 0.05mm/s until a fracture occurred. The fracture load value was recorded The fatigue test cyclic loads were carried out by applying 200N and 600N onto the tooth to simulate normal and three times occlusal forces, respectively. Three samples each from the WOC and WC groups were tested at each cyclic load (200N and 600N). The number of cycles at each load was set at 100000 because this number simulated chewing and swallowing for one half year.

AE analysis

Signals detected by the AE transducer were passed through 40 dB gain preamplifiers with a band pass of 100k~2MHz (Fig. 2). The AE signals were recorded during the load period.

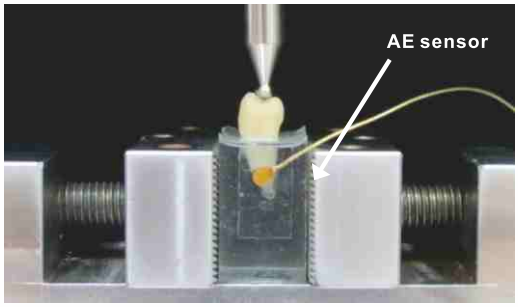

Fig.2 One of the tested restored tooth samples included a stainless steel sphere in contact with the buccal and lingual cusps for axial load and an AE signal wide band transducer glued with resin to the sample embedded in a resin block.

Results and Discussion

Table 1 Fracture load and accumulated number of AE signal in static fracture test

Restoration design	Fracture load (Mean ± SD)	P value	Accumulated number AE signal (Mean ± SD)	P value
WOC	1427 ± 309	0.322	15±2	*0.018
WC	1559 ± 337		4±2	

*significant difference (p<0.05)

-WOC and WC are non-significant differences (p > 0.05) in fracture load

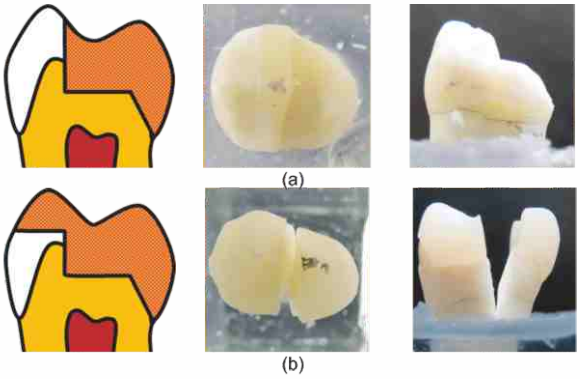

Fig.4 Fracture modes of the WOC and WC restored teeth after fracture tests

(a)WOC：Micro-cracks within the restored tooth

(b)WC：The fracture type was from the central fossa to the deep root region (Cannot be repaired again).

Conclusion

Within the limitations of this in vitro study, non-significant differences in the tested fracture loads and accumulated number of AE signals under normal occlusal force (200N) in fatigue testing were found for palatal cusp-replacing ceramic premolar treatment between with and without buccal cuspal coverage restorations. Aggressive treatment (with coverage preparation) requires more care in preserving and protecting the remaining tooth structure.

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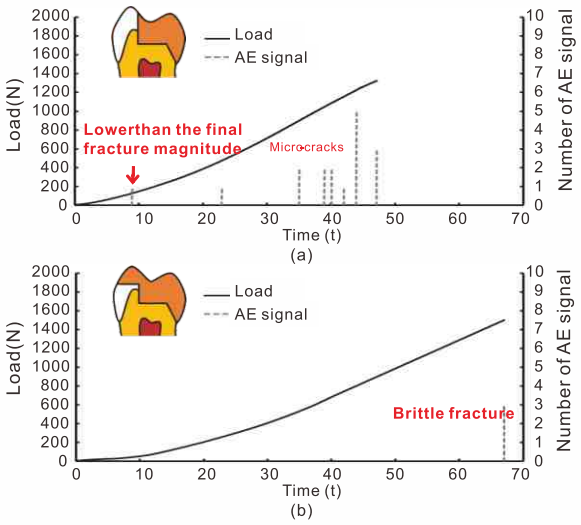

Fig.3 Typical example of AE signals in load/loading time graphs in fracture test for (a) WOC restoration and (b) WC restoration.

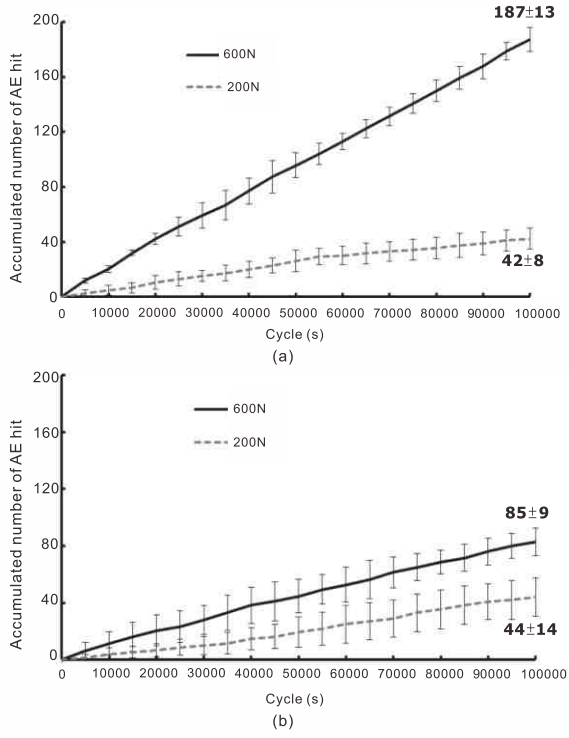

Fig.5 Accumulated number of AE signals versus number of cyclic load during normal (200N) and high (600N) occlusal forces fatigue testing for: (a) WOC restoration and (b) WC restoration.

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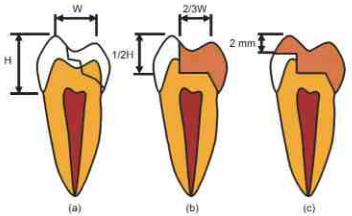

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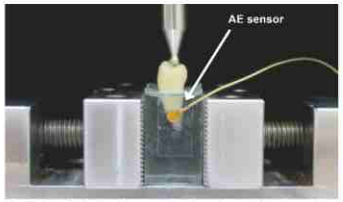

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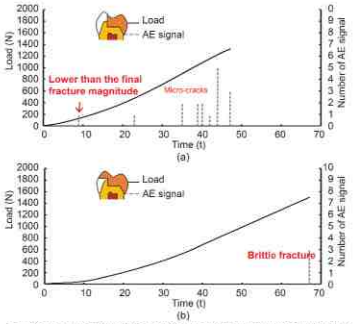

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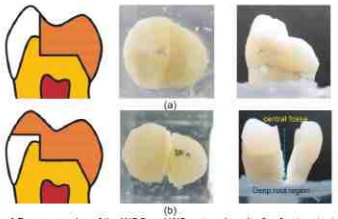

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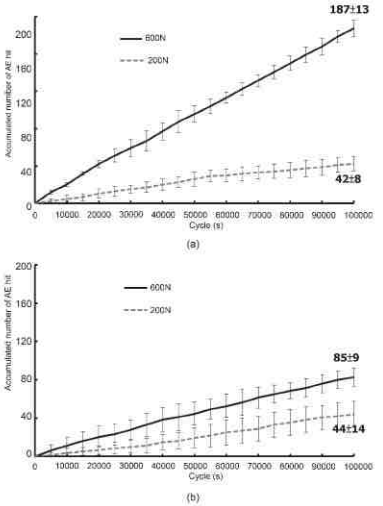

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學術專題 Dental Scholarship

壁報論文比賽 No.2作品 劉宥孛

論文原稿

探討all-on-four傾斜植體的贋復假牙存活率及應力,及運用傾斜植體於臨床的可行性

劉宥勃[1] 吳兆鴻[2] 江正陽[3] 黃國光[4]
國軍桃園總醫院[1] 三軍總醫院[2 3 4]

背景

上下顎骨癆常常因為拔除牙齒後,造成骨癆吸收及上顎竇氣室擴張,造成日後的植體贋復的困難,往往需藉由引導骨再生術（Guided Bone Regeneration）、onlay type bone grafting，植體支撐覆蓋式義齒（implant-supported overdentures），或者鼻竇增高術。但這些術式有缺點：例如：需要取自體骨造成另外的傷口，手術次數增加，補骨手術完後病患需等待時間延長，延後植體贋復時間造成病人的不便，及因下顎齒槽骨嚴重吸收如果使用需要黏膜組織支持的overdenture，可能會造成病患不適感。在近幾年文獻中顯示all-On-four的觀念運用在上下顎均無牙的病人，不僅減少手術範圍及整體治療時間,提高病患接受度,以及日後的追蹤觀察結果良好。本篇藉由評估 implant及all-on four concept傾斜植體在全口重建的長期的存活率及探討放置傾斜植體對整體的植體贋復物應力的評估。

傾斜植體成功率，贋復假牙生存率及併發症

評估顱骨植體（zygomatic implant）成功率,大部份學者均認定的標準如下：1，植體的穩定度2，在假牙贋復期間及受力後是否出現疼痛或感染的現象3，植體周邊在X光片上是否顯示出radiolucency及4，由all-on-four所贋復假牙是否穩定.以上述的標準來評估，在 15位學者所作的顱骨植體（zygomatic implant）追蹤的報告顯示整體平均成功率為97.05%（如table I）[1]，另外由14位學者在上顎及下顎全顎無牙病人運用all-on-four概念製作植體支持固定牙橋，平均成功率98.35%（如table II）[2]，且上顎及下顎贋復假牙受力後追蹤報告顯示沒有統計上顯著的差異（上顎99.3%；下顎100%）[3]。在Landes發表的文章顯示出運用overdentures重建15個病人，經過13-102個月追蹤,成功率為89%,大部份植體在放置後3-6個月loading，有些文章指出delayed loading顯示出較高的成功（80-100%），但是也些指出immediate loading 的成功率為96.4-100%。運用Zygomatic implant所致作的贋復的併發症為上顎竇炎，發生率介於1.85 to 18.42%,其他較少數的併發症為牙齦發炎、感染瘻管產生、麻木感、植體骨整合失敗及贋復物斷裂 。

傾斜植體應力探討

有些學者指出單一傾斜的植體會增加骨頭的應力，然而也有研究顯示出如果用superstructure把多顆植體連結一起，指出應力集中在傾斜或非傾斜的植體並沒有明顯的差異。根據早期一些學者研究，cantilever的長度和骨頭的loading有正相關，根據Takeshi 在2010研究中利用three-dimensional finite element model for stress analysis 評估 0、15、30、45度傾斜植體，在all on 4 concept情況下分析植體的應力分布，結果顯示：loading在植體系統的superstructure的cantilever最末端，顯示出增加implant angle 的inclination可以減少應力分布集中，其中45度傾斜的植體對於應力減少最多，顯示出利用傾斜的植體造成cantilever變短，進而減少應力集中。

討論

植體周圍的骨整合維持可以藉由骨頭生理的dynamic modeling and remodeling processes。然而根據Hoshaw et al.植體周圍所承受的應力若超過Pathologic overload window 將造成植體頸部周圍骨質吸收，另外有一些文章指出太大的應力集中可能會造成植體的骨整合失敗,植體齒頸部骨質吸收。所以可以運用傾斜植體可以縮短cantilever的效應在all on 4 concept概念上，減少應力集中於齒頸部減少植體周圍骨的吸收。另外傾斜植體放置在bone anchorage量比較多的的情況下達到較好的primary stability。在回顧近年幾篇回顧zygomatic或傾斜植體長期追蹤的成功率，整體平均成功率達97.05%，根據Massimo Del Fabbro et al 2010 在文章回顧中指出loading之後不論是在上下顎的植體頸部的骨吸收在直立或傾斜植體均是相似，除了Calandriello and Tomatis et al 2005 的文章中提到傾斜植體的骨吸收比直立植體量更少且長期追蹤大部份併發症為上顎竇發炎及贋復假牙斷裂。根據Enrico Agliardi et al 2010,長期追蹤運用all-on four concept贋復假牙斷裂機率為15.6%，與Francetti et al. (2008) and Agliardi et al. (2008) 的追蹤後結果斷裂比率11%相近，然而另有文章報導斷裂比率27%（Malo et al.2003），大部份贋復物斷裂的案例為男性、短臉型、主要發生在3到6個月咬合負載，推測造成支援因為這段時期為從軟的食物轉到硬的食物所造成。

結論

若可以避免上顎的生理結構及設計及製作良好的贋復物，且運用all-on four concept在上下顎均全部無牙的病患，運用植體贋復全顎固定假牙時可以考慮運用傾斜植體來減少固定假牙贋復物承受咬合力所造成的cantilever的應力集中於最末段植體齒頸部，並且減少病患接受補骨手術的次數及減少植體贋復的治療時間。

TABLE II all-on-four贋復假牙生存率

作者	病人	植體數	追蹤時間（月）	假牙生存率
Charles A. Babbush et al 2010	165	790（上顎436）（下顎272）	29	99.6%
Malo et al 2005	32	129（上顎）	12	97.6%
Testori et al 2008	41	246	60	98.8%
Aparicio et al. 2001	25	101（上顎）	60	96.5%
Calandriello et al. 2005	18	60（上顎33）	12	96.7%
Malo et al. 2003	44	176（下顎）	12	98.2%
Agliardi E et al. 2010	24	96（下顎）	42	100%
Roberto Weinstein et al. 2010	20	80（下顎）	60	100%
Paulo Maló et al 2006	46	189 44上顎,9 下顎	12	98.9%
Malo et al 2007	18	72	12	97.2%
Malo et al 2007	5	20	12	100%
Pomares et al 2006	20	127（19上顎 9下顎）	24	96.9%
Agliardi E et al. 2010	173	692（404上顎 288上顎）	60	99.04%
Malo et al. 2005	32	129（上顎）	12	97.6%

(Table III) 傾斜植體或顱骨植體追蹤觀察後併發症

作者	併發症
JOHANSON Y COLS. 2010	6.8% 鼻竇腔破裂
MALÓ Y COLS. 2008	13.7 % 鼻竇炎
JOAN PI Y COLS. 2008	1,8% 鼻竇炎 1.8% 假牙斷裂
KAHNBERG Y COLS. 2007	3,3 % 感染,紅腫在植體周圍 18,4% 鼻竇炎 3,9 % 感染,瘻管 1,3% 疼痛 13% 假牙斷裂
APARICIO Y COLS. 2006	4.3 % 鼻竇炎 8,7 % 臉部血腫 7,2 % 暫時裂傷 11,6 % 牙齦發炎 9.2 % 假牙斷裂
DAVO Y COLS. 2006	5.5 %鼻竇炎
BECKTOR Y COLS. 2005	9,7 % 鼻竇炎 56,3 % 局部感染
HIRSCH Y COLS. 2004	1.5% 鼻竇痛 7.5% 感染,瘻管 12.2% 牙齦炎 9.1% 神經暫痛

TABLE I 顱骨植體贋復假牙生存率

作者	病人數	植體數	追蹤時間（月）	植體成功率
STIEVENART et al 2010	20	80	40	96%
JOHANSON et al 2010	44	61	12-60	98.8%
LANDES et al 2009	15	36	13-102	89%
BALSHI Y COLS. 2009	56	110	60	96.4%
MALÓ Y COLS. 2008	29	67	18	98.5%
JOAN PI Y COLS. 2008	54	101	72	96.1%
APARICIO CY COLS. 2008	20	36	36-48	100%
PEÑARROCHA Y COLS. 2007	21	40	12-45	100%
BOYES VARLEY Y COLS. 2007	20	40	69	100%
PEÑARROCHA Y COLS. 2007	23	44	12	97.7%
KAHNBERG Y COLS. 2007	76	145	36	96.3%
APARICIO Y COLS. 2006	69	131	60	100%
DAVO Y COLS. 2006	18	36	29	100%
BECKTOR Y COLS. 2005	16	31	69	90.3%

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14年2月24日星期一

論文原稿

Influence of Personality Characteristics on Patient's Compliance to Periodontal Non-surgical Therapy

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Background

It is well known that untreated periodontitis leads to loss of teeth, function, and aesthetics[1], and it adversely affects one's systemic health, quality of life, and economic productivity as do other untreated chronic oral diseases[2]. However, despite advances in technology, knowledge, and skills over the last few decades, epidemiological studies have indicated that prevalence rates are not reflective of the periodontal care delivered. In other words, most existing disease is left untreated[3].

Many papers have discussed patient compliance with supportive periodontal therapy[4], but only limited studies have addressed periodontal nonsurgical therapy[5].Besides, although social, behavioral, cultural, and economic factors have also been implicated in determining patterns of compliance, the influence of personality characteristics on attitudes driving these behavioral responses remains to be carefully explored.

Because patient's adherence to dental visit is essential for periodontal treatment success. The aim of this study is to evaluate the association between personality characteristics of patients and their compliance with periodontal non-surgical therapy.

Materials and Methods

Patients suffering from periodontitis and visiting at the Department of Periodontology for the first time were asked to participate in a study assessing the influence of personality characteristics to individual's compliance to periodontal non-surgical therapy. Each patient gave signed informed consent. Inclusion criteria were as follows: (1) Generalized chronic periodontitis (Workshop, 1999). (2) Presence more than 16 teeth of full mouth. (3) More than 6 sites present probing pocket depth ≥ 5mm. Exclusion criteria were as follows: (1) Non-periodontal disease. (2) Gingival hyperplasia due to medication (such as calcium channel blocker, antiepileptic and immunosuppressant). (3) Pregnancy. (4) Debilitating diseases (such as AIDS, cancer, and autoimmune diseases).

All participants received the motivational interview guided by Leventhal's theory. One operator involved in the study was introduced to the practice of motivational interviewing. The motivational interviews were approximately 3 hours, the explanation of causes, treatment, preventive methods and charge status were addressed naturally during the ensuing discussion that ensued.

After consultation, every participates were issued basic personality inventory (BPI) questionnaire which was validated in Taiwan in a sample of 2,133 participants aged 19 to 62 years, and answered at second appointment (Fig. 1). The BPI is comprised of 150 questions that evaluate ten main domains of personality. For each domain, 15 questions can be answered as: Depression (Dep), Anxiety (Axy), Social Introversion (SoI), Self Depreciation (SDp), Interpersonal Problems (IPs), Impulse Expression (ImE), Deviation (Dev), Hypochondriasis (Hyp), Persecutory Ideas (Pld) and Thinking Disorder (ThD).

Results

70 subjects of 99 participates (55 ± 10.15 years old) answered the questionnaires and the response ratio was 70.71%. Among the responders, 46 questionnaires were valid (Fig. 2). In incomplete subjects, 55.56% with high score (>60) of the interpersonal problems. Moreover, a significant association of the high score with the incomplete therapy ($p = 0.007$) was noted (Table 1). The odds ratio was 21.875 for the incomplete therapy for the patients who presented with the high score compared to those with the low score.

Discussion

Different from other studies focusing on compliance with supportive periodontal therapy.This study emphasized patient compliance with periodontal non-surgical therapy. It also provides a new look at the patient's personality trails for its relation to his or her compliance. Our results suggest that patients with interpersonal problems have higher ratio incomplete the periodontal non-surgical therapy.

It may because they are often extremely annoyed by little inconveniences, frustrations, or disappointments and response uncooperative, disobedient, resistant to others and reacts against discipline, rules and criticism. Among many personal reasons,
we think the greatest challenge in periodontics is understanding the influence of personality characteristics on the level of compliance in periodontal non-surgical therapy. In this context, this knowledge can be an important tool to improve the patients's compliance and adherence to non-surgical or surgical programs. Therefore, the main goal of the present study seemed to be obtainable.

Conclusion

Personality traits, mainly interpersonal problems, showed significant influences on compliance among patients under periodontal non-surgical therapy. Interpersonal problems might be a risk factor to patients's compliance to periodontal non-surgical therapy.

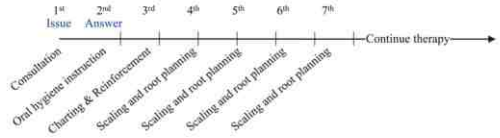

Fig. 1. The flowchart of this study. Periodontal non-surgical therapy include 7 appointments. Issue the BPI questionnaires at first appointment and answer the BPI questionnaires at second appointment.

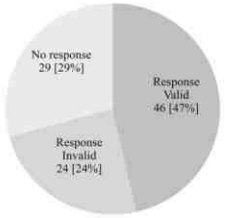

Fig. 2. The status of patients answer the questionnaires. 99 subjects participate this study and 70 (71%) subjects answer the questionnaire. Among the responders, 46 (66%) questionnaires were valid and 24 (34%) questionnaires were invalid.

Table 1. The relationship between complete/incomplete compliance and personality characteristics over periodontal non-surgical therapy

Compliance	Score Mean ± SD	n	Personality trails	Score < 40 n [%]	*p* value	Score > 60 n [%]	*p* value
Complete	48 ± 6.82	37	Depression	4 [10.81 a]	1.000	3 [8.10 a]	0.999
Incomplete	51 ± 11.10	9		1 [11.11 b]		1 [11.11 b]	
Complete	47 ± 8.92	37	Anxiety	10 [27.03 a]	0.999	2 [5.41 a]	0.973
Incomplete	45 ± 6.18	9		2 [22.22 b]		0 [0.00 b]	
Complete	49 ± 8.29	37	Social Introversion	7 [18.92 a]	0.989	4 [10.81 a]	0.056
Incomplete	58 ± 10.56	9		1 [11.11 b]		5 [55.56 b]	
Complete	52 ± 10.70	37	Self Depreciation	0 [0.00 a]	X	7 [18.92 a]	0.927
Incomplete	59 ± 19.26	9		0 [0.00 b]		3 [33.33 b]	
Complete	47 ± 7.38	37	Interpersonal Problems	10 [27.03 a]	0.999	2 [5.41 a]	0.007 ★
Incomplete	53 ± 11.44	9		2 [22.22 b]		5 [55.56 b]	
Complete	50 ± 8.12	37	Impulse Expression	3 [8.11 a]	0.999	4 [10.81 a]	0.900
Incomplete	49 ± 6.41	9		1 [11.11 b]		0 [0.00 b]	
Complete	50 ± 6.44	37	Deviation	0 [0.00 a]	X	2 [5.41 a]	0.984
Incomplete	53 ± 12.01	9		0 [0.00 b]		1 [11.11 b]	
Complete	53 ± 10.35	37	Hypochondriasis	3 [8.11 a]	0.895	9 [24.32 a]	0.946
Incomplete	55 ± 7.61	9		0 [0.00 b]		1 [11.11 b]	
Complete	53 ± 8.05	37	Persecutory Ideas	0 [0.00 a]	X	6 [16.22 a]	0.853
Incomplete	57 ± 9.61	9		0 [0.00 b]		3 [33.33 b]	
Complete	47 ± 5.10	37	Thinking Disorder	1 [2.70 a]	0.993	0 [0.00 a]	X
Incomplete	49 ± 7.09	9		0 [0.00 b]		0 [0.00 b]	

★ Significant difference
a Percentage of complete compliance
b Percentage of incomplete compliance
X Can not be calculated

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壁報論文比賽

No.3作品 蔡蔭玲

Risk indicators for early childhood caries in Taiwan

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Taiwan's economy has progressed steadily and the health status of the people in Taiwan has also improved considerably (1). However, the prevalence of dental caries is one exception to these advances in the economy and health status. A national survey showed that the prevalence of dental caries in elementary and junior high school students was approximately 94% (2). A recent study reported that the prevalence of caries among preschool-aged children was between 85% and 88% (3). However,only a limited number of studies have documented the occurrence of dental caries for preschool -aged children in Taiwan. The most recent large-scale dental survey was conducted in 1971, and in that survey, the mean deft was 4.3 for 3-year olds and 8.5 for 5-year olds (4).

Early childhood caries (ECC), which involves children under the age of 6 years, encompassses specific teeth and surfaces (5). Traditionally, dental caries have been measured by the mean number of decayed, missing, and filled teeth/surfaces (deft/defs). The deft/s may not be the most useful and appropriate index for caries studies because of the high population variance and non-normal distribution of caries (6). Caries prevalence among different populations and its extent in individuals varies. Sites of dental caries in the primary dentition seem to be related to varying etiologies. Thus,there is a need for a more descriptive caries index (7-10). Major caries site groupings related to etiology include, for example, pit and fissure caries and caries of the proximal surface of molars. While the concept of caries occurrence in a specific pattern has an intuitive basis, the use of cluster analysis has confirmed the notion that children develop caries in fairly small numbers of distinct patterns (11). The timing of appearance of specific caries can be tracked by assessing caries patterns for specific age groups, beginning with the youngest children in a population. The affliction of a specific type of caries and its pattern have not been studied systematically in Taiwan. Such a study could be used as a basis for estimation of the current dental status and future needs for oral health care. As fluoride is not added to the water in Taiwan, a systematic study of caries experience and patterns at each age group could show the progression of the disease in a population with a cultural and fluoridation status distinct from other nations, such as the United States (12).

This national dental health survey of children younger than the age of 6 in Taiwan was conducted from the years of 1995 to 1997. The purpose of this investigation included the following: 1) to develop and evaluate caries patterns and to determine the national estimates of ECC and S-ECC for children between the age of 0 and 6 years, and 2) to study the relationship between disease characteristics and prevalence as well as the risk indicators within this population.

[Table 1]
Caries (ECC) prevalence and mean deft, mean defs among Taiwanese children in relation to age.

Age (year)	No of children	% children affected±SD	d	E	f	deft±SD	%of d/deft	d	e	f	defs±SD	%of d/defs
1	114	0.0±0.00	0	0	0	0.0±0.00	0	0	0	0	0±0.00	0
2	182	5.09±2.97	0.14	0	0	0.14±0.95	100	0.20	0	0	0.2±1.51	100
3	182	60.12±6.61	2.58	0	0	2.58±3.55	100	4.71	0	0	4.71±7.83	100
4	178	75.00±5.58	4.33	0	0.08	4.41±4.31	98	8.26	0.01	0.17	8.44±10.32	98
5	147	89.13±3.77	6.65	0.05	0.25	6.94±5.19	96	15.78	0.24	0.43	16.45±17.01	96
6	178	89.38±4.11	6.72	0.14	0.44	7.31±5.04	92	17.11	0.72	0.80	18.64±15.57	92

[Table 2]
Percentage of children for each age group with reported oral health behaviors.

Age (year)	% of parents reported having children's teeth brushed at least once a day	% of children took a bottle to bed or slept with bottles	% of children favored sweet snacks
1	67.73	79.05	32.11
2	30.04	81.78	74.06
3	33.61	70.96	73.74
4	37.22	76.11	83.73
5	31.86	69.65	79.30
6	43.90	63.31	77.54

Methods and Materials

The total number of cities, villages, and townships in Taiwan is 309. These geographic locations were divided into ten administrative strata based upon the socioeconomic status (SES) and degree of urbanization as follows: 1) developing area; 2) mountainous area; 3) industrial area; 4) hilly area; 5) remote area; 6) service business area; 7) combination area; 8) metropolitan area in Taipei city (northern area of Taiwan); 9) metropolitan area in Kaoshiung city (southern area of Taiwan); 10) five well developed county administration centers. We designated the population elements into these ten strata. The sample design in this study was based on the principle of stratification, using multi-stage sampling with unequal sample probability. Each population group had a different chance to appear in the sample due to different location, age, and gender characteristics. The population of interest in this investigation was Taiwanese children under age six, excluding children in the orphanages. Taipei, Kaoshiung, and five other cities were categorized as high urbanization areas. The medium urbanization category consisted of the developing, industrial, and service business areas. Finally, the mountainous, remote, and hilly areas were clustered as low urbanization groups.

In this survey, two-stage sampling was conducted within each stratum to assure random sampling. The first stage was the selection of districts from 10 strata using the Probabilities Proportional to Sizes method. The number of sampling districts for each stratum was proportional to the number of children under age six within each stratum. There were 25 districts represented in this study. In the second stage, cluster sampling was conducted to select a sample of 15 blocks from each sampled district. Each block was composed of 15 geographically neighboring house units. Hence, there were 225 household sampling units within each sampled district. In each house sample, children under the age six were the subjects of this survey.

Computer selected two-dimensional random coordinate points were applied to the position of each district on the map. A valid coordinate point determined the first house unit of a sampling block. A valid coordinate point had to contain 15 neighboring house units within a radius of 100 meters. The maps played an important role in our survey. However, current maps could not completely describe the most recent and precise distribution of all streets. Therefore, in the process of selecting blocks, a Global Position System was utilized to help determine the position of the first house unit.

House visitors were sent to each random sampling home unit to introduce the survey and to invite the family to participate in this survey. If there were children under the age of 6 in the house unit, the child would be scheduled for a dental examination.

A total of 5625 house units were sampled and 1681 house units had children under the age of 6. A total of 981 children were available for dental examinations. Children who were absent from the household during survey were asked to take the examination on the following day. If the child was not available on the following day,, he/she was excluded from the study. Dental examinations that excluded radiographs were

performed by three pediatric dentists. The examination procedure, instruments used, and diagnostic criteria were based on the WHO guidelines (13).

Parental interviews were carried out by trained interviewers. The parent or the caregiver was also asked to complete a questionnaire about their child which provided information in the following areas: demographics, medical and dental history, diet/feeding habits, bottle weaning and brushing/oral hygiene practice.

Interexaminer calibration was done by comparing independent dental examinations of randomly selected children. Calibration studies were carried out in a local kindergarten where twenty 3- to 5 -year-old children were assessed. Values for kappa statistics for the interexaminer agreement (14) were 0.97 and 0.98.

Caries classifications were based on caries site grouping. Five caries patterns were classified based on site of formation.(8):

ECC is defined as ‘‘the presence of one or more decayed, missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger ‘‘. In children younger than three years of age, any sign of smooth surface caries is indicative of Severe Early Childhood Caries (S-ECC). From ages 3 to 5, S-ECC is defined as one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth(definition no. 1), or decayed, missing or filled score of ≧4 (age 3), ≧5(age 4), or ≧6(age 5) surfaces constitutes S-ECC (definition no. 2) (5).

[Table3]
Multiple logistic regression analysis for the risk of caries among children 0-6 year-old in Taiwan

Variables	Caries	No caries	OR	95% CI
Age (year)				
1	0.00%	100.00%	0	(0, ∞)
2	9.34%	90.66%	1	(--,--)
3	57.69%	42.31%	13.75*	(7.48,25.26)
4	77.53%	22.47%	37.44*	(19.28,72.70)
5	91.16%	8.84%	103.52*	(45.94,233.27)
6	92.70%	7.30%	127.09*	(56.09,287.94)
Sex				
Females	56.70%	43.30%	1	(--,--)
Males	57.22%	42.78%	1.40	(0.96,2.05)
Area (Urbanization)				
High	51.72%	48.28%	1	(--,--)
Medium	60.00%	40.00%	1.73*	(1.03,,2.91)
Low	56.27%	43.73%	2.39*	(1.39,4.11)
Favored sweet snacks				
N	42.16%	57.84%	1	(--,--)
Y	63.58%	36.42%	1.65*	(1.07,2.55)
Unknown	28.57%	71.43%	1.13	(0.24,5.39)
Brush teeth before bed time				
Unknown	32.29%	67.71%	0.78	(0.50,1.23)
Every night	75.89%	24.11%	1	(--,--)
No	73.63%	26.27%	1.83*	(1.06,3.16)

[Table4]
Loglinear regression model for the risk of increasing number of ECC among children 0-6 year-old in Taiwan

Independent Variables	Mean ±Sd.	Median	Q1,Q3	Min,Max	Odds Ratios	95% Confidence Limits	
Sex							
Female	3.92 ± 4.77	2	(0 · 7)	(0 · 20)	1.06	0.99	1.13
Male	3.98 ± 4.87	2	(0 · 7)	(0 · 20)	1.00	--	--
Age(year)							
1	0 ± 0	0	(0 · 0)	(0 · 0)	0	0	∞
2	0.29 ± 1.43	0	(0 · 0)	(0 · 16)	1.00	--	--
3	2.58 ± 3.36	1	(0 · 4)	(0 · 14)	8.95*	6.70	11.96
4	4.70 ± 4.18	4	(1 · 7)	(0 · 20)	15.81*	11.89	21.02
5	7.54 ± 5.00	8	(4 · 11)	(0 · 20)	25.24*	18.98	33.55
6	7.94 ± 4.89	8	(4 · 11)	(0 · 20)	26.74*	20.12	35.53
Ranking of siblings							
1	3.88 ± 4.66	2	(0 · 7)	(0 · 20)	1.00	--	--
2	4.02 ± 4.91	2	(0 · 7)	(0 · 20)	1.14*	1.06	1.22
3	3.96 ± 4.92	2	(0 · 8)	(0 · 20)	1.06	0.97	1.16
>=4	3.83 ± 4.98	2	(0 · 6)	(0 · 20)	1.16	0.97	1.40
Unknown	5.30 ± 6.33	2	(0 · 12)	(0 · 16)	8.25*	3.05	22.32
Get Snack Easily							
NO	2.92 ± 4.17	0	(0 · 9)	(0 · 20)	1.18	0.67	2.09
YES	5.22 ± 5.22	4	(0 · 5)	(0 · 20)	1.41	0.80	2.49
Unknown	3.71 ± 5.63	0	(0 · 9)	(0 · 16)	1.00	--	--
Sweet consumption							
Dislike	2.49 ± 3.93	0	(0 · 1)	(0 · 16)	3.22*	1.19	8.73
Like	4.56 ± 5.00	3	(0 · 8)	(0 · 20)	4.10*	1.51	11.09
Unknown	2.57 ± 5.02	0	(0 · 4)	(0 · 20)	1.00	--	--
Brush Tooth Everyday							
NO	5.83 ± 5.23	5	(1 · 10)	(0 · 20)	1.89*	1.02	3.48
YES	4.98 ± 4.69	4	(0 · 8)	(0 · 20)	1.59	0.86	2.95
Unknown	2.03 ± 3.88	0	(0 · 2)	(0 · 20)	1.00	--	--
Brush Before Bedtime							
NO	5.22 ± 5.12	4	(0 · 9)	(0 · 20)	1.06	0.98	1.15
YES	5.43 ± 4.87	5	(1 · 9)	(0 · 20)	1.00	--	--
Unknown	2.05 ± 3.89	0	(0 · 2)	(0 · 20)	1.67	0.90	3.09

Statistics

The likelihood of developing caries due to a specific factor was presented as an odds ratio, which is an indicator for the strength of association. The statistical significance was tested with Mantel-Haenszel chi-square test in univariate analyses while a multiple logistic regression and stratified analyses were applied to the tests in multivariate models adjusting to the confounding variables. Graphic plots were employed to present the distribution and relationship between risk factors and caries status in this study.

Results

All of the data were weighted according to the 1995 national census of population distribution. The increased deft score from 0.14 at age 2 to 2.58 at age 3 is an increase of 17 fold (Table 1). Distribution of caries patterns for all age groups is shown in Figure 1. The prevalence of ECC for children in this national survey for all ages was 56%.Table 1 shows caries prevalence for specific age groups. Figures 2 and 3 illustrate different deft/defs scores in relation to various identified caries patterns. Tables 5 presents various defs scores for identified caries patterns and defs of ECC and S-ECC children at different ages. Analysis of the survey questions regarding oral health behavior revealed that the practice of tooth brushing in this population was limited (Table 2).

Information was collected on the children's snack habits (Table 2). 73% to 83% of the children older than 2 years were reported to favor sweet snacks. Table 3 shows that children with ECC consumed more sweet snacks than the non-caries children, and the difference was statistically significant (Odds Ratio=1.65, P<0.05).This pattern of disease was age related, with more caries being seen in children of older age groups (Table 3). Table 4 shows that birth order was associated with the severity of caries.

Conclusions

This study provides the first nationwide report on caries prevalence of Taiwanese children. The findings of this survey indicated a high level of untreated caries among children in Taiwan.

【Table 5】

Comparison of defs of various caries patterns,ECC,S-ECC and the traditional defs of different ages

Item / age (year)	pit and fissure	facial/ lingual	molar proximal	F/L molar proximal	ECC defs	S-ECC defs	Traditional defs
1	0	0	0	0	0	0	0
2	1.6	6.82	0	0	4.88	6.82	0.2
3	3.98	9.24	7.33	26.67	7.34	9.87	4.71
4	4.15	11.82	10.82	24.86	11.76	16.56/14.08*	8.44
5	3.7	10.19	10.54	30.07	19.49	23.69/22.86*	16.45
6	5.05	8.7	10.79	30.34	21.73	26.09/25.19*	18.64

*defs by S-ECC difinition#2

Fig.1 Percentages of children with identified caries patterns

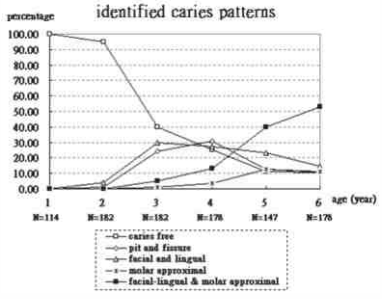


Fig.2 Identified caries patterns and deft.

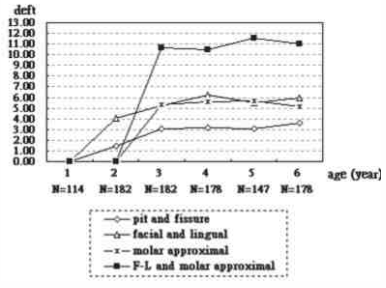
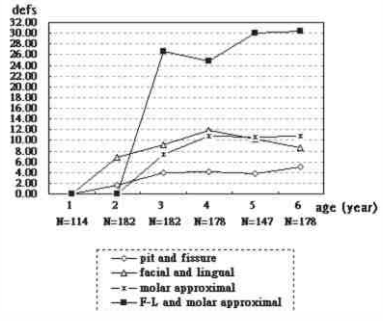


Fig.3 Identified caries patterns and defs



論文原稿

Risk indicators for early childhood caries in Taiwan

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Taiwan's economy has progressed steadily and the health status of the people in Taiwan has also improved considerably (1). However, the prevalence of dental caries is one exception to these advances in the economy and health status. A national survey showed that the prevalence of dental caries in elementary and junior high school students was approximately 94% (2). A recent study reported that the prevalence of caries among preschool-aged children was between 85% and 88% (3). However,only a limited number of studies have documented the occurrence of dental caries for preschool -aged children in Taiwan. The most recent large-scale dental survey was conducted in 1971, and in that survey, the mean deft was 4.3 for 3-year olds and 8.5 for 5-year olds (4).

Early childhood caries (ECC), which involves children under the age of 6 years, encompassses specific teeth and surfaces (5). Traditionally, dental caries have been measured by the mean number of decayed, missing, and filled teeth/surfaces (deft/defs). The deft/s may not be the most useful and appropriate index for caries studies because of the high population variance and non-normal distribution of caries (6). Caries prevalence among different populations and its extent in individuals varies. Sites of dental caries in the primary dentition seem to be related to varying etiologies. Thus,there is a need for a more descriptive caries index (7-10). Major caries site groupings related to etiology include, for example, pit and fissure caries and caries of the proximal surface of molars. While the concept of caries occurrence in a specific pattern has an intuitive basis, the use of cluster analysis has confirmed the notion that children develop caries in fairly small numbers of distinct patterns (11). The timing of appearance of specific caries can be tracked by assessing caries patterns for specific age groups, beginning with the youngest children in a population. The affliction of a specific type of caries and its pattern have not been studied systematically in Taiwan. Such a study could be used as a basis for estimation of the current dental status and future needs for oral health care. As fluoride is not added to the water in Taiwan, a systematic study of caries experience and patterns at each age group could show the progression of the disease in a population with a cultural and fluoridation status distinct from other nations, such as the United States (12).

This national dental health survey of children younger than the age of 6 in Taiwan was conducted from the years of 1995 to 1997. The purpose of this investigation included the following: 1) to develop and evaluate caries patterns and to determine the national estimates of ECC and S-ECC for children between the age of 0 and 6 years, and 2) to study the relationship between disease characteristics and prevalence as well as the risk indicators within this population.

Methods and Materials

The total number of cities, villages, and townships in Taiwan is 309. These geographic locations were divided into ten administrative strata based upon the socioeconomic status (SES) and degree of urbanization as follows: 1) developing area; 2) mountainous area; 3) industrial area; 4) hilly area; 5) remote area; 6) service business area; 7) combination area; 8) metropolitan area in Taipei city (northern area of Taiwan); 9) metropolitan area in Kaoshiung city (southern area of Taiwan); 10) five well developed county administration centers. We designated the population elements into these ten strata. The sample design in this study was based on the principle of stratification, using multi-stage sampling with unequal sample probability. Each population group had a different chance to appear in the sample due to different location, age, and gender characteristics. The population of interest in this investigation was Taiwanese children under age six, excluding children in the orphanages. Taipei, Kaoshiung, and five other cities were categorized as high urbanization areas. The medium urbanization category consisted of the developing, industrial, and service business areas. Finally, the mountainous, remote, and hilly areas were clustered as low urbanization groups.

In this survey, two-stage sampling was conducted within each stratum to assure random sampling. The first stage was the selection of districts from 10 strata using the Probabilities Proportional to Sizes method. The number of sampling districts for each stratum was proportional to the number of children under age six within each stratum. There were 25 districts represented in this study. In the second stage, cluster sampling was conducted to select a sample of 15 blocks from each sampled district. Each block was composed of 15 geographically neighboring house units. Hence, there were 225 household sampling units within each sampled district. In each house sample, children under the age six were the subjects of this survey.

Computer selected two-dimensional random coordinate points were applied to the position of each district on the map. A valid coordinate point determined the first house unit of a sampling block. A valid coordinate point had to contain 15 neighboring house units within a radius of 100 meters. The maps played an important role in our survey. However, current maps could not completely describe the most recent and precise distribution of all streets. Therefore, in the process of selecting blocks, a Global Position System was utilized to help determine the position of the first house unit.

House visitors were sent to each random sampling home unit to introduce the survey and to invite the family to participate in this survey. If there were children under the age of 6 in the house unit, the child would be scheduled for a dental examination.

A total of 5625 house units were sampled and 1681 house units had children under the age of 6. A total of 981 children were available for dental examinations. Children who were absent from the household during survey were asked to take the examination on the following day. If the child was not available on the following day,, he/she was excluded from the study. Dental examinations that excluded radiographs were performed by three pediatric dentists. The examination procedure, instruments used, and diagnostic criteria were based on the WHO guidelines (13).

Parental interviews were carried out by trained interviewers. The parent or the caregiver was also asked to complete a questionnaire about their child which provided information in the following areas: demographics, medical and dental history, diet/feeding habits, bottle weaning and brushing/oral hygiene practice.

Interexaminer calibration was done by comparing independent dental examinations of randomly selected children. Calibration studies were carried out in a local kindergarten where twenty 3- to 5 -year-old children were assessed. Values for kappa statistics for the interexaminer agreement (14) were 0.97 and 0.98.

Caries classifications were based on caries site grouping. Five caries patterns were classified based on site of formation.(8):

ECC is defined as "the presence of one or more decayed, missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger ". In children younger than three years of age, any sign of smooth surface caries is indicative of Severe Early Childhood Caries (S-ECC). From ages 3 to 5, S-ECC is defined as one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth(definition no. 1), or decayed, missing or filled score of ≧4 (age 3), ≧5(age 4), or ≧6(age 5) surfaces constitutes S-ECC (definition no. 2) (5).

Statistics

The likelihood of developing caries due to a specific factor was presented as an odds ratio, which is an indicator for the strength of association. The statistical significance was tested with Mantel-Haenszel chi-square test in univariate analyses while a multiple logistic regression and stratified analyses were applied to the tests in multivariate models adjusting to the confounding variables. Graphic plots were employed to present the distribution and relationship between risk factors and caries status in this study.

Results

All of the data were weighted according to the 1995 national census of population distribution. The increased deft score from 0.14 at age 2 to 2.58 at age 3 is an increase of 17 fold (Table 1). Distribution of caries patterns for all age groups is shown in Figure 1. The prevalence of ECC for children in this national survey for all ages was 56%.Table 1 shows caries prevalence for specific age groups. Figures 2 and 3 illustrate different deft/defs scores in relation to various identified caries patterns. Tables 5 presents various defs scores for identified caries patterns and defs of ECC and S-ECC children at different ages. Analysis of the survey questions regarding oral health behavior revealed that the practice of tooth brushing in this population was limited (Table 2).

Information was collected on the children's snack habits (Table 2). 73% to 83% of the children older than 2 years were reported to favor sweet snacks. Table 3 shows that children with ECC consumed more sweet snacks than the non-caries children, and the difference was statistically significant (Odds Ratio=1.65, P<0.05).This pattern of disease was age related, with more caries being seen in children of older age groups (Table 3). Table 4 shows that birth order was associated with the severity of caries.

Conclusions

This study provides the first nationwide report on caries prevalence of Taiwanese children. The findings of this survey indicated a high level of untreated caries among children in Taiwan.

Fig.1 Percentages of children with identified caries patterns

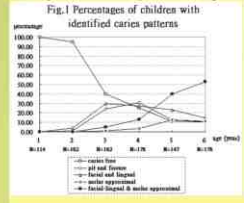


Fig.2 Identified caries patterns and deft.

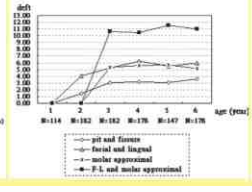
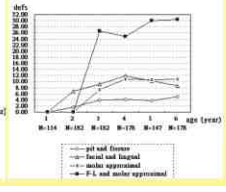


Fig.3 Identified caries patterns and defs



[Table 1]
Caries (ECC) prevalence and mean deft, mean defs among Taiwanese children in relation to age

Age (year)	No of children	% children affected(SE)	d=	E=	f=	deft±SD=	%of d>0	d=	e=	f=	defs±SD=	%of d>0
1=	114=	0.00(0.00)=	0=	0=	0=	0.00(0.00)=	0=	0=	0=	0=	0(0.00)=	0=
2=	182=	3.09(2.07)=	0.14=	0=	0=	0.14(0.80)=	10=	0.28=	0=	0=	0.29(1.51)=	10=
3=	182=	60.12(6.61)=	2.58=	0=	0=	2.58(3.80)=	100=	4.71=	0=	0=	4.71(7.83)=	100=
4=	178=	75.00(5.58)=	4.33=	0=	0.08=	4.41(4.21)=	98=	8.26=	0.01=	0.17=	8.44(10.32)=	98=
5=	147=	89.13(3.77)=	6.65=	0.05=	0.25=	6.94(5.29)=	96=	15.78=	0.24=	0.43=	16.45(17.01)=	96=
6=	178=	89.38(4.11)=	6.72=	0.14=	0.44=	7.31(5.06)=	92=	17.31=	0.72=	0.80=	18.64(15.87)=	92=

[Table 2]
Percentage of children for each age group with reported oral health behaviors

Age (year)=	% of parents reported having children's teeth brushed at least once a day=	% of children took a bottle to bed or slept with bottles=	% of children favored sweet snacks=
1=	67.73=	79.05=	32.11=
2=	58.04=	81.78=	74.06=
3=	53.61=	70.96=	73.34=
4=	57.22=	76.11=	83.73=
5=	51.86=	69.65=	79.30=
6=	43.90=	63.31=	77.54=

[Table3]
Multiple logistic regression analysis for the risk of caries among children 0-6 year-old in Taiwan

Variables=	Caries=	No caries=	OR=	95% CI=
Age (year)=	=	=	=	=
1=	0.00%=	100.00%=	0=	(0, ∞)=
2=	9.34%=	90.66%=	1=	(--,--)=
3=	57.69%=	42.31%=	13.75*=	(7.48,25.26)=
4=	77.53%=	22.47%=	37.44*=	(19.28,72.70)=
5=	91.16%=	8.84%=	103.52*=	(45.94,233.27)=
6=	92.70%=	7.30%=	127.09*=	(54.08,297.94)=
Sex=	=	=	=	=
Females=	36.70%=	63.30%=	1=	(--,--)=
Males=	37.22%=	62.78%=	1.40=	(0.96,2.05)=
Area (Urbanization)=	=	=	=	=
High=	31.72%=	68.28%=	1=	(--,--)=
Medium=	60.00%=	40.00%=	1.73*=	(1.03,2.91)
Low=	36.27%=	63.73%=	2.39*=	(1.39,4.11)=
Favored sweet snacks=	=	=	=	=
N=	62.16%=	37.84%=	1=	(--,--)=
Y=	63.59%=	36.42%=	1.65*=	(1.07,2.55)=
Unknown=	28.57%=	71.43%=	1.13=	(0.24,5.39)=
Brush teeth before bed time=	=	=	=	=
Unknown=	32.29%=	67.71%=	0.78=	(0.50,1.23)=
Every night=	75.89%=	24.11%=	1=	(--,--)=
No=	73.63%=	26.27%=	1.83*=	(1.06,3.16)=

[Table4]
Loglinear regression model for the risk of increasing number of ECC among children 0-6 year-old in Taiwan

Dependent Variables	Mean ±Std.	Median	Q1 Q3	Min Max	Odds Ratios	95% Confidence Limits
Sex						
Female	3.92 ± 4.77	2	(0 - 7)	(0 - 20)	1.06	0.89 , 1.13
Male	3.99 ± 4.87	2	(0 - 7)	(0 - 20)	1.00	-- , --
Age(year)						
1	0 ± 0	0	(0 - 0)	(0 - 0)	0	0 , ∞
2	0.20 ± 1.43	0	(0 - 0)	(0 - 16)	1.00	-- , --
3	2.58 ± 3.36	1	(0 - 4)	(0 - 14)	8.95*	6.70 , 11.96
4	4.70 ± 4.18	4	(1 - 7)	(0 - 20)	15.91*	11.89 , 21.02
5	7.34 ± 5.00	8	(4 - 11)	(0 - 20)	25.24*	18.98 , 33.55
6	7.94 ± 4.89	8	(4 - 11)	(0 - 20)	26.74*	20.12 , 35.53
Ranking of children						
1	3.88 ± 4.66	2	(0 - 7)	(0 - 20)	1.00	-- , --
2	4.02 ± 4.91	2	(0 - 7)	(0 - 20)	1.14*	1.06 , 1.22
3	3.96 ± 4.92	2	(0 - 9)	(0 - 20)	1.06	0.97 , 1.16
>=4	3.83 ± 4.90	2	(0 - 6)	(0 - 20)	1.16	0.97 , 1.40
Unknown	5.30 ± 6.33	2	(0 - 12)	(0 - 16)	0.25*	3.05 , 22.32
Get Snack Easily						
NO	2.92 ± 4.17	0	(0 - 9)	(0 - 20)	1.18	0.67 , 2.09
YES	5.22 ± 5.22	4	(0 - 5)	(0 - 20)	1.41	0.80 , 2.49
Unknown	3.71 ± 5.63	0	(0 - 9)	(0 - 16)	1.00	-- , --
Sweet consumption						
Dislike	2.49 ± 3.93	0	(0 - 1)	(0 - 16)	3.22*	1.39 , 8.73
Like	4.56 ± 5.00	3	(0 - 8)	(0 - 20)	4.10*	1.51 , 11.09
Unknown	2.37 ± 5.02	0	(0 - 4)	(0 - 20)	1.00	-- , --
Brush Teeth Everyday						
NO	5.03 ± 5.23	5	(1 - 10)	(0 - 20)	1.09*	1.02 , 3.40
YES	4.90 ± 4.69	4	(0 - 8)	(0 - 20)	1.39	0.88 , 2.95
Unknown	2.03 ± 1.88	0	(0 - 2)	(0 - 20)	1.00	-- , --
Brush Before Bedtime						
NO	5.22 ± 5.12	4	(0 - 9)	(0 - 20)	1.06	0.98 , 1.15
YES	5.43 ± 4.87	5	(1 - 9)	(0 - 20)	1.00	-- , --
Unknown	2.05 ± 3.89	0	(0 - 2)	(0 - 20)	1.67	0.90 , 3.09

[Table 5]
Comparison of deft of various caries patterns,ECC,S-ECC and the traditional defs of different ages

Item / age (year)	pit and fissure	facial/ lingual	molar proximal	Fit/ molar proximal	ECC/ deft	S-ECC/ defs	Traditional/ defs
1=	0=	0=	0=	0=	0=	0=	0=
2=	1.6=	6.82=	0=	0=	4.88=	6.82=	0.2=
3=	3.96=	9.24=	7.33=	26.67=	7.34=	9.87=	4.71=
4=	4.15=	11.82=	10.82=	24.86=	11.76=	16.56/14.08*=	8.44=
5=	3.7=	10.19=	10.54=	30.07=	19.49=	23.69/22.86*=	16.45=
6=	5.05=	8.7=	10.79=	30.34=	21.73=	26.09/25.19*=	18.64=

*defs by S-ECC definition#2=