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The prevalence of dens evaginatus and apical periodontitis in dens evaginatus in a group of Thai schoolchildren

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Abstract

Objective This study aims to determine the prevalence of dens evaginatus and apical periodontitis in dens evaginatus in a group of Thai schoolchildren.

Materials and methods In carrying out the study, a total number of 9,279 schoolchildren, aged between 9-18, from 18 schools in Muang District, Kanchanaburi Province were examined, preliminary at their schools. Those found to have dens evaginatus were brought to the Dental Section, Paholpolpayuhasena Hospital to be reexamined and to undergo periapical radiograph on each dens evaginatus. Apical periodontitis was then diagnosed by using Periapical Index Score. Data was analyzed statistically by Chi-square test at $\alpha = 0.05$.

Results Three hundred out of 9,279 schoolchildren, or 3.2 percent, were found to have at least one dens evaginatus tooth. Statistically, there appeared no significant difference in the findings between male and female ($p > 0.05$). Five hundred and nineteen out of 549 dens evaginatus (283 of 300 schoolchildren) were permitted to undergo periapical radiographs, from which 33.1 percent exhibited apical periodontitis. While the difference between gender was not significant ($p > 0.05$), the difference among age group was found to be significant ($p < 0.05$). Schoolchildren aged between 9-10 had the lowest frequency of apical periodontitis.

Conclusion As the study revealed the prevalence of dens evaginatus in 3.2% of cases and 33.1% apical periodontitis found in dens evaginatus, the clinicians should recognize dens evaginatus after it has erupted in the oral cavity and observe the affected teeth in a timely manner. In necessary cases, preventive or prophylactic treatment should be performed to avoid pathological conditions.

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Key words: *apical periodontitis; dens evaginatus; periapical index; prevalence*

Introduction

Though dens evaginatus (DE) was first reported in 1892 and has been well documented since 1925[1], recently there still has been reported about DE and its complications such as pulpal and periapical pathology, facial infection and cellulitis.[2-5] Apical periodontitis (AP) is an inflammatory disorder of periradicular tissues caused by persistent microbial infection of the root canal system of the affected tooth. It has been the subject of numerous terms and classifications such as periapical lesion, apical granuloma and cyst, periapical osteitis, and periradicular lesions.[6]

DE is a rare developmental anomaly of a tooth characterized by the presence of an extra cusp, tubercle, elevation, protuberance, excrescence, extrusion or bulge protruding from the occlusal surface of posterior teeth and from the lingual surface and rarely from the labial surface of anterior teeth.[1,7-10] DE has been given various names, such as tuberculated premolar,[11] odontomes of the axial core type,[12] evaginated odontome,[13] Mongoloid or oriental premolar,[13] Leong's premolar,[14] cone-shaped supernumerary cusp.[15] For anterior teeth, it is called talon cusp.[16]

The etiology of DE remains undetermined. DE is thought to be the proliferation and evagination of an area of the inner enamel epithelium and subjacent dental papilla that is derived from ectomessenchyme[17] into the enamel organ during early stage of tooth development[18]. The resulting extra cusp or tubercle contains a core of dentin surrounding a pulpal extension, which may be narrow, wide, constricted, an isolated horn or not present at all.[7] This anomaly has great clinical significance and distinguishes from supplemental cusp such as the cusp of Carabelli which contains no pulp, occurring most often on the palatal aspect of the mesiolingual cusp of maxillary first molar.[1]

According to the number of reports, DE occurs commonly in people in the Mongoloid racial group[2,7,11-15,19-21] which includes the Indian of North, Central and South America, the Eskimos and the people in East and Southeast Asia. DE has been observed in Japanese, Chinese, Keewatin Eskimo, Alaskan Eskimo, American Indian, Singaporean (Chinese and Malay), Thai, Filipino and Vietnamese people,[7,13,14,20-22] and in Chilean (Pre-Columbian Mongoloid population) mummies.[23] However, there are few reports of DE occurrences in Caucasoid[24,25] and Negroid racial group.[26]

The prevalence of DE is between 0.5-4.3 percent, depending upon the population group studied.[1] In some reports, the prevalence is up to 6.3[19] and 21.5[23] percent. In Thailand, the prevalence of DE is found between 1.01-1.8 percent.[20,27,28] DE is most commonly observed in premolars but may occur in molars, canines and incisors[8-10,20] and it occurs in the mandible five times more than in the maxilla.[7,20,21]

Since the extra cusp or tubercle usually occurs bilaterally and on the lingual surface of the buccal cusp or in the center of the occlusal surface and tubercle is usually at a level higher than the level of cusps, it can be worn easily or fractured when the tooth comes into occlusion with the opposing tooth[21], resulting in pulpal exposure, pulpal infection, infection of root canal system that may advance to facial infection, cellulitis and osteomyelitis.[2-5,29] Several studies indicate that 14.1 to 40.2 percent of DE exhibits pulpal and periapical involvement.[11,14,20,21]

Many treatment options for DE have been reported in the literatures and they have changed over time.[1,30-32] Depending on pulpal condition, apical maturation, and symptoms, the recommended management of DE ranges from preventive treatment, prophylactic treatment, pulpotomy, pulpectomy, conventional root canal therapy, apexification, root-end resection, root-end restoration, to extraction. To avoid costly endodontic regimen, early detection of DE followed by prophylactic intervention is advisable.

This study was conducted on the DE and its complications, focusing on the occurrence of AP in Thai schoolchildren in Muang District, Kanchanaburi Province. In identifying the prevalence and distribution of DE, it is expected that the results of the study may contribute to a better understanding of the existence as well as current situation of DE in Thailand.

Materials and Methods

A total number of 9,279 schoolchildren from 18 schools in Muang District, Kanchanaburi Province were examined and selected as the samples of this study. Selection of target sample was subject to the following criteria: a) 9-18 years of age, b) Thai ethnic, and c) having at least one premolar erupted. Those criteria are based upon the fact that most DE affects the premolars that erupt at the age between 9-12[33], after which those premolars start to move towards occlusion. It takes approximately 5 years for the teeth to involve from the time of crown completion to full eruption and occlusion.[34] In case of premolar tooth, the crown completion takes place when the children are about 5-7 years old.[33] Thus, at the age of 10-12, the child's premolars are in full eruption and occlusion. By the time the child reaches the age of 18, the time is long enough for the DE cusp to be traumatized, worn, or fractured, resulting in pulpal exposure, pulpal infection, initial AP, and chronic AP that can be detected by radiograph.[6]

The oral examinations were preliminary carried out in the school's health room where the children were seated in the office chairs. In conducting the examination, basic oral examination instruments and an artificial-light lamp were used. In cases of questionable DE diagnosis, a loupe telescope (Sergitel®, General Scientific Corporation, Michigan, USA.) with x2.5 magnification was used to provide the examiner with a larger and clearer vision to make the final diagnosis. Prior to the oral examination, the parents of the schoolchildren had given informed consent in writing.

Those children found to have DE, with informed consent signed by their parents, were then brought to reexamine at the Dental Section, Paholpolpayuhasena Hospital. The samples underwent periapical radiograph on each DE. The DE with caries or restoration was excluded from this study because AP may be caused by caries, not by DE and the restored DE may not cause AP. All radiographs were taken by an Intra OS 70 model Blue X X-ray unit (Jico Intertrade Co. Ltd., Thailand), with the long cone paralleling technique using XCP devices (Rinn Co., Elgin, IL, USA.). The X-ray unit was set at 70 kV, 7 mA and a film-focus distance of 20 cm and the Ultra Speed film (Eastman Kodak, Rochester, New York, USA.) were used. The films were processed manually by an experienced assistant.

The periapical radiograph on each DE is recorded according to the FDI nomenclature. The Periapical Index (PAI) score[35,36] is used in the assessment of periapical status. Each of the roots is classified in one of the following categories, i.e. 1) normal periapical structure, 2) small changes in bone structure and bone mineral content, but is characterized by a disorganization of bone texture periapically, 3) changes in bone structure with some mineral loss and may have a "shot-gun" appearance, 4) classical chronic apical periodontitis with well-defined radiolucent area, and 5) severe peridontitis with exacerbating features. Each category used in the PAI represented a step on an ordinal scale of registration of periapical infection. The worst score of all roots was taken to represent the PAI score for multirooted teeth.[35]

The method for viewing the periapical radiographs was standardized, whereby the films were examined in the dark room using an illuminated viewer box with x3.5 magnification and mounted in a cardboard slit to block off the ambient light from the viewer box.

Interpretation of radiographs was performed independently by two dentists, both of whom had got a

graduate diploma in Endodontology and have had clinical experience in endodontics for at least five years. Before providing interpretation, they had been informed about the PAI scoring system, with reference to the radiographs and corresponding line drawing from the report of ørstavik and coworkers.[35] Together, they had calibrated the scoring by examining the number of radiographs for two months and reached a consensus on the interpretation of each radiograph. In theory, the PAI system quantifies periapical inflammation, and scores 2 to 5 represent disease. In epidemiological study, score of 2 or greater (PAI ≥ 2) was considered to be sign of periapical pathology.[35] Thus, the PAI scores of 2, 3, 4 and 5 define AP.

In this study, the PAI scores were recorded as either PAI ≥ 2 (DE with AP) or PAI < 2 (DE without AP). In questionable cases where the two interpreters gave contradictory scores, third opinion was sought from another endodontist with a more extensive experience and the final PAI score was obtained. In case of the DE with immature apex or wide open apex, they were carefully interpreted to distinguish AP from normal dental follicle by noticing the existence of the radiopaque line of the lamina dura circumscribing normal open apex or normal dental follicle.[37]

Raw data was input into Microsoft Access® (Microsoft Corporation, Redmond, WA, USA.). The Chi-square test was used to determine significance of difference between genders for DE, and between genders and among age groups for AP (α=0.05), using the SPSS program 11.5 for Windows (SPSS, Inc., Chicago, IL, USA.).

Results

From the total number of 9,279 samples, 300 samples (140 males and 160 females) were found to have one or more DE. According to the findings, the prevalence of DE was 3.2 percent (Table 1). Statistically, there was no significant difference between the prevalence found in male and female (χ^2 = 1.92, df = 1, p = 0.166).

Distribution of 549 DE (by teeth) in those 300 individuals was illustrated in Figure 1. Five hundred and forty out of the 549 DE were found in the premolars (98.4 percent), another 6 in canines and 3 in the upper lateral incisors. The ratio between the lower premolar DE to the upper premolar DE was 8:1. Distribution of DE was as follows; 49.5 percent on the mandibular second premolars, 38.4 percent on the mandibular first premolars, 6.7 percent on the maxillary second premolars, 3.6 percent on the maxillary first premolars, 1.1 percent on the maxillary and mandibular canines, and only 0.5 percent on the maxillary lateral incisors. The number of DE found in each individual was as follows; 1 DE in 153 persons (51 percent), 2 DE in 99 persons (33 percent), 3 DE in 21 persons (7 percent), 4 DE in 20 persons (6.7 percent), 5 DE in 3 persons (1 percent), and 6 DE in 4 persons (1.3 percent).

A total of 283 out of 300 persons (94.5 percent) with 519 out of 549 DE were permitted to take

Table 1 Prevalence of dens evaginatus (DE) by gender

	DE		no DE		Total	
	persons	%	persons	%	persons	%
Gender (p =0.166)						
Male	140	3.0	4,571	97.0	4,711	100
Female	160	3.9	4,408	96.5	4,568	100
Total	300	3.2	8,979	96.8	9,279	100

periapical radiograph. From the radiograph interpretation, the PAI score of equal or greater than 2 (PAI ≥ 2) was 172 and the PAI score lesser than 2 (PAI < 2) was 347. Thus, 172 AP was found in 519 DE and the prevalence of AP was 33.1 percent (Table 2). There was no statistically significant difference between the prevalence found in male and female (χ^2 = 0.417, df = 1, p = 0.518). However, there are significant differences between age groups (χ^2 = 15.672, df = 4, p = 0.003). The age group of 9-10 exhibits the lowest frequency of AP.

Discussion

The prevalence of DE obtained from the study was illustrated and compared with the previous studies of DE in other ethnic groups, especially in Mongoloid racial population, in Table 3. In Thailand, there were only three previous studies on the prevalence of DE (Reichart and Tantiniran[20], in Chiangmai Province in 1975, Arunyanart[27] in Bangkok in 2002, and Sukaram[28] in Bangkok in 2004). Their results were quite different from the results of this study. Firstly,

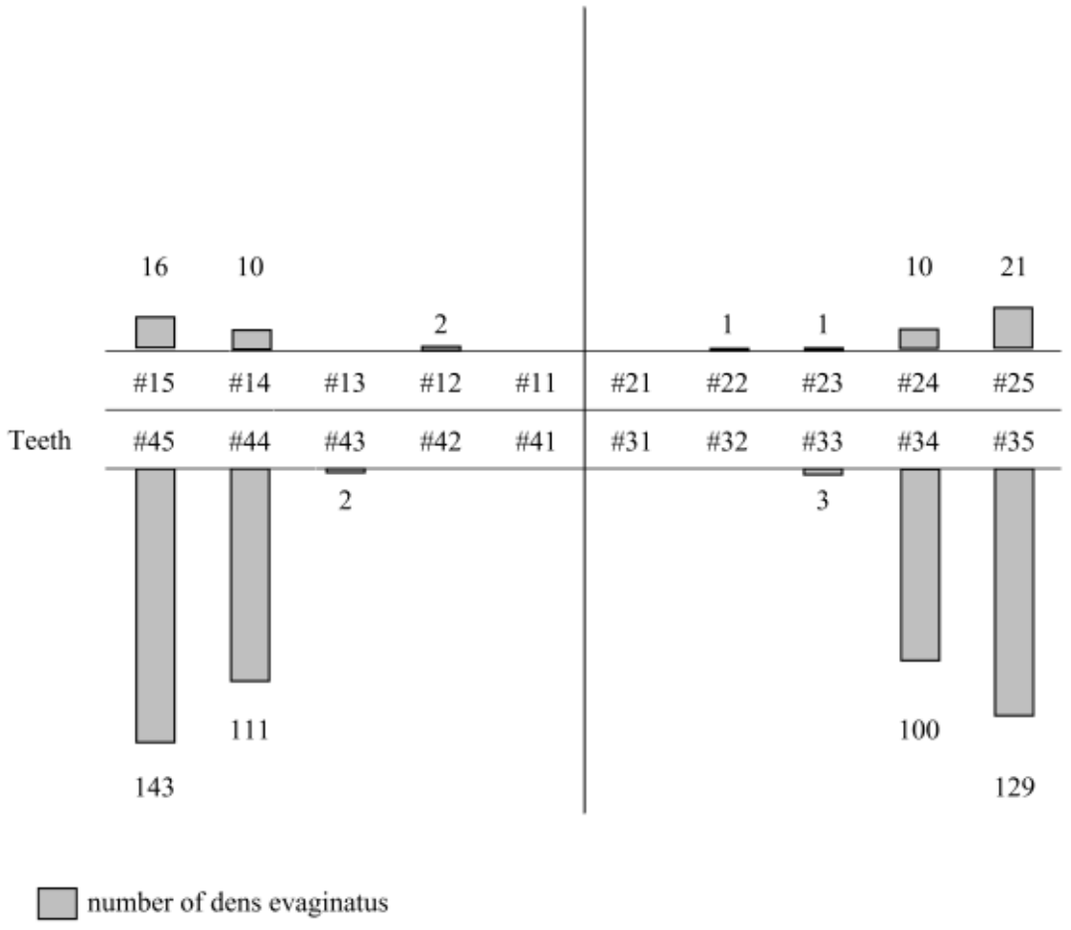

Fig.1 The distribution of 549 dens evaginatus from 300 persons

the 3.2 percent prevalence of DE found in this study was about twice to triple the percentage found in those studies. Secondly, the findings of DE in this study were in premolars, canines and lateral incisors, while in other studies the DE were found only in premolars (except one which was found in molar in the study by Reichart and Tantiniran[20]). Thirdly, this study showed no statistically significant difference between the results found in male and female. The proportion was 1:1.16, compared with 1:1.83 in Reichart and Tantiniran's[20], 1:1.91 in Arunyanart's[27] and 1:2.17 in Sukaram's[28]. Even though the occurrence of prevalence of DE in female was twice the number of male in Sukaram's study, there was no significant difference between genders in her study.[25]

Differences among the results of the studies conducted in Thailand may depend on the sample size used and area of sampling. The sample size of this study was 9,279, the largest ever in Thailand.

When DE tubercle was ground or fractured, resulting in pulp exposure, AP was primarily an inflammatory sequel. However, some studies report that intact DE could cause AP.[5] In this study, AP in DE was diagnosed by apical radiographic evaluation using the PAI scoring system, which was found to be reasonably accurate and suitable for the analysis of periapical radiograph in the clinical and epidemiological studies of AP.[35] The measure has been modified and also applied to the epidemiological studies on some European population.[38,39]

The prevalence of AP among DE was 33.1 percent. The percentage of finding was high enough for dental practitioners to pay more attention and make an early assessment of this pathosis. The clinically asymptomatic AP in DE patients, could only be detected by chance when they came to receive treatment for other dental problems. Occasionally, the patients were referred to endodontists when acute exacerbation had occurred and endodontic treatments were needed. In case of AP in the teeth with incomplete root formation, the complicated endodontic treatments were required such as apexification, apicoectomy and retrograde filling. If the endodontic procedure failed or the patients could not afford the treatment fee, they would lose their teeth.

Table 2 Prevalence of apical periodontitis (AP) in dens evaginatus by gender and age

	AP		without AP		Total	
	teeth	**%**	**teeth**	**%**	**teeth**	**%**
Gender (p = 0.518)						
Male	77	34.7	145	65.3	222	100
Female	95	32.0	202	68.0	297	100
Total	172	33.1	347	66.9	519	100
Age group (p = 0.003)						
9-10	3	7.1	39	92.9	42	100
11-12	35	36.1	62	63.9	97	100
13-14	70	38.5	112	61.5	182	100
15-16	34	33.3	68	66.7	102	100
17-18	30	31.3	66	68.8	96	100
Total	172	33.1	347	66.9	519	100

Thus, it is important for the clinicians to early recognize and observe DE eruption. To avoid pathological conditions, preventive or prophylactic treatment should be performed, depending on DE's morphology and pulp horn, or whether it was worn or fractured.

In this study, the prevalence of AP among DE in the age group of 9-10 was the lowest (7.1 percent) and increased rapidly to 36.1 percent in the next age group of 11-12. The reason may be that, at the age of 9-10, most affected teeth were anterior teeth. Since DE was seldom found in the anterior teeth, the chance of AP occurrence is thus low. Besides, only a few premolars just started to erupt in the oral cavity and were not yet in full eruption and occlusion. Thus, there was a slight chance for trauma or fracture of DE's cusp to occur. A few number of AP was therefore found in this age group.

At the age group of 11-12, there was more chance for trauma or fracture of DE's cusp because most premolars, especially the lower premolars in which DE was mostly found (Fig. 1), have already been erupted in the oral cavity, and moved towards occlusion, or were already in full eruption and occlusion. The statistics of AP finding in this age group was thus notable.

As for the next age group of 13-14, 15-16 and 17-18, the number of premolars was constant and the AP had already occurred. So, the prevalence of AP in these age groups was not different (Table 2).

Conclusion

This study revealed that the prevalence of DE in schoolchildren in Muang District, Kanchanaburi Province is 3.2 percent and the prevalence of AP in DE is 33.1 percent. The relatively high prevalence of AP in DE should prompt the clinicians to recognize DE and to observe the affected teeth soon after they have erupted in the oral cavity. In necessary cases, preventive or prophylactic treatment should be performed to avoid pathological conditions. The further studies should be conducted to explore the current practice of Thai dentists, general practitioners, pedodontists, and endodontists alike, regarding the management of DE and accompanying AP.

Table 3 Prevalence of dens evaginatus in Mongoloid racial population

Author	Year	Ethnic group	Number of population	Prevalence (%)
Kato[cited by 13]	1937	Japanese	1467	1.09
Lau[12]	1955	Hong Kong Chinese	2101	1.29
Merill[14]	1964	Alaskan Eskimos and Indians	650	4.30
Curzon *et al*[13]	1970	Keewatin Eskimos	399	3.00
Yip[21]	1974	Singaporean Chinese	579	3.62
Yip[21]	1974	Singaporean Malays	280	1.07
Reichart & Tantiniran[20]	1975	Thais (Chiang Mai)	5696	1.01
Arunyanart[27]	2002	Thais (Bangkok)	1790	1.79
Sukaram[28]	2004	Thais (Bangkok)	1141	1.8
Cho *et al*[19]	2006	Hong Kong Chinese	7102	6.3
Suksamai (present study)	2008	Thais (Kanchanaburi)	9279	3.2

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ความชุกของฟันเดนส์อิแวจิเนทัส และเอพิคอลเพอริโอดอนไททิสในฟันเดนส์อิแวจิเนทัสในเด็กนักเรียนไทยกลุ่มหนึ่ง

ศุภกร สุขสมัย วท.บ., ทบ., ป. บัณฑิตวิทยาศาสตร์การแพทย์คลินิก (วิทยาเอ็นโดดอนต์)

กลุ่มงานทันตกรรม โรงพยาบาลพหลพลพยุหเสนา อำเภอเมืองกาญจนบุรี จังหวัดกาญจนบุรี

บทคัดย่อ

วัตถุประสงค์ เพื่อหาความชุกของฟันเดนส์อิแวจิเนทัส และเอพิคอลเพอริโอดอนไททิสในฟันเดนส์อิแวจิเนทัสในเด็กนักเรียนไทยกลุ่มหนึ่ง

วัสดุและวิธีการ สำรวจเด็กนักเรียนอายุ 9-18 ปี จากโรงเรียน 18 แห่งในเขตอำเภอเมืองกาญจนบุรี จังหวัดกาญจนบุรี จำนวน 9,279 คน โดยทำการศึกษาเบื้องต้นที่โรงเรียน จากนั้นนำผู้ที่ตรวจพบฟันเดนส์อิแวจิเนทัสมาตรวจทางคลินิกและถ่ายภาพรังสีที่กลุ่มงานทันตกรรม โรงพยาบาลพหลพลพยุหเสนาเพื่อวินิจฉัยว่าฟันเดนส์อิแวจิเนทัสแต่ละซี่เป็นเอพิคอลเพอริโอดอนไททิสหรือไม่ โดยใช้คะแนนเพอริเอพิคอลอินเด็กซ์ เป็นเกณฑ์ตัดสิน นำผลที่ได้มาวิเคราะห์ทางสถิติโดยใช้การทดสอบด้วยไคสแควร์ ที่ระดับนัยสำคัญ 0.05

ผลการศึกษา เด็กนักเรียน 300 คนจาก 9,279 คน หรือร้อยละ 3.2 พบว่ามีฟันเดนส์อิแวจิเนทัสอย่างน้อย 1 ซี่ และไม่พบความแตกต่างระหว่างเพศชายกับเพศหญิงอย่างมีนัยสำคัญทางสถิติ ($p > 0.05$) ฟันเดนส์อิแวจิเนทัสจำนวน 519 ซี่ จาก 549 ซี่ (เด็กนักเรียน 283 คนจาก 300 คน) ได้รับอนุญาตให้มาถ่ายภาพรังสีและพบว่าร้อยละ 33.1 ของฟันเดนส์อิแวจิเนทัสมีสภาวะเอพิคอลเพอริโอดอนไททิส ไม่พบความแตกต่างของเอพิคอลเพอริโอดอนไททิสระหว่างเพศชายกับเพศหญิง แต่พบความแตกต่างระหว่างกลุ่มอายุอย่างมีนัยสำคัญทางสถิติ ($p < 0.05$) โดยพบเอพิคอล เพอริโอดอนไททิสน้อยที่สุดในกลุ่มเด็กอายุ 9-10 ปี

สรุป จากการศึกษานี้พบความชุกของฟันเดนส์อิแวจิเนทัสเท่ากับร้อยละ 3.2 และร้อยละ 33.1 ของฟันเดนส์อิแวจิเนทัส มีสภาวะเอพิคอลเพอริโอดอนไททิส ทันตแพทย์จึงต้องให้ความสำคัญในการตรวจหาและเฝ้าระวังเมื่อพบฟันเดนส์อิแวจิเนทัสขึ้นมาในช่องปาก และให้การรักษาเพื่อการป้องกันในรายที่จำเป็นเพื่อหลีกเลี่ยงพยาธิสภาพที่จะเกิดตามมาในภายหลัง

(ว ทันต จุฬาฯ 2551;31:43-52)

คำสำคัญ : *ความชุก; เดนส์อิแวจิเนทัส; เพอริเอพิคอลอินเด็กซ์; เอพิคอลเพอริโอดอนไททิส*