ปัจจัยที่เกี่ยวข้องกับฟันผุในเด็กสมองพิการในช่วงก่อนวัยเรียน
ที่เข้ารับบริการในศูนย์ฝึกกายภาพบำบัดขององค์กรพัฒนาเอกชน

นางสาวกุลนันท์ พันธ์ศรีมังกร

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University

บทคัดย่อและแฟ้มข้อมูลฉบับเต็มของวิทยานิพนธ์ตั้งแต่ปีการศึกษา 2554 ที่ให้บริการในคลังปัญญาจุฬาฯ (CUIR)
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FACTORS ASSOCIATED WITH DENTAL CARIES EXPERIENCE IN THAI PRESCHOOL CHILDREN WITH CEREBRAL PALSY ATTENDING NON-GOVERNMENTAL REHABILITATION CENTERS

Miss Kullanant Pansrimangkorn

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Pediatric Dentistry
Department of Pediatric Dentistry
Faculty of Dentistry
Chulalongkorn University
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กุลนันท์ พันธ์ศรีมังกร : ปัจจัยที่เกี่ยวข้องกับฟันผุในเด็กสมองพิการในช่วงก่อนวัยเรียน ที่เข้ารับบริการในศูนย์ฝึกกายภาพบำบัดขององค์กรพัฒนาเอกชน (FACTORS ASSOCIATED WITH DENTAL CARIES EXPERIENCE IN THAI PRESCHOOL CHILDREN WITH CEREBRAL PALSY ATTENDING NON-GOVERNMENTAL REHABILITATION CENTERS) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ทพญ. ดร. บุษยรัตน์ สันติวงศ์, หน้า.

วัตถุประสงค์ เพื่อศึกษาปัจจัยที่เกี่ยวข้องกับประสบการณ์ฟันผุของเด็กสมองพิการช่วงก่อนวัยเรียน ที่เข้ารับบริการที่ศูนย์ฝึกกายภาพบำบัดในศูนย์เรียนรู้และฟื้นฟูเด็กพิการขององค์กรพัฒนาเอกชน ในกรุงเทพมหานคร

วิธีวิจัย งานวิจัยนี้เป็นการศึกษาชนิดตัดขวางในเด็กสมองพิการอายุ 3-6 ปี จำนวน 60 คน อายุเฉลี่ย 5.01 ± 1.23 ปี ประสบการณ์ฟันผุใช้ดัชนีฟันผุ ถอน อุด (ด้าน) และเก็บข้อมูลปัจจัยที่เกี่ยวข้องได้แก่ ดัชนีคราบจุลินทรีย์ ทำการสัมภาษณ์แบบมีโครงสร้างกับผู้ดูแลหลัก ถึงชนิดของภาวะสมองพิการ ความถี่ของการบริโภคอาหารประเภทคาร์โบไฮเดรตระหว่างมื้อ ความเหนียวข้นของอาหาร ความช่วยเหลือในการแปรงฟัน ความถี่ในการแปรงฟัน นำข้อมูลมาวิเคราะห์ความสัมพันธ์โดยใช้สถิติถดถอยพหุ ที่ระดับนัยสำคัญ 0.05

ผลการวิจัย กลุ่มตัวอย่างมีประสบการณ์ฟันผุร้อยละ 91.66 ค่าเฉลี่ยของดัชนีฟันผุ ถอน อุด 20.30 ± 21.63 ด้านต่อคน ผลการวิเคราะห์ความสัมพันธ์ด้วยสถิติถดถอยพหุ พบว่า ประสบการณ์ฟันผุมีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติกับ การบริโภคอาหารประเภทคาร์โบไฮเดรตระหว่างมื้อมากกว่า 2 ครั้งต่อวัน ($p = 0.003$) และภาวะสมองพิการชนิดเกร็ง ($p = 0.040$) ส่วนปัจจัยอื่นไม่มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ

สรุป ประสบการณ์ฟันผุในเด็กสมองพิการช่วงก่อนวัยเรียนมีความสัมพันธ์ต่อการบริโภคอาหารประเภทคาร์โบไฮเดรตระหว่างมื้อมากกว่า 2 ครั้งต่อวัน และภาวะสมองพิการชนิดเกร็ง

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ภาควิชา ทันตกรรมสำหรับเด็ก ลายมือชื่อนิสิต .....

สาขาวิชา ทันตกรรมสำหรับเด็ก ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ปีการศึกษา 2560

5875806032 : MAJOR PEDIATRIC DENTISTRY
KEYWORDS: CEREBRAL PALSY / DENTAL CARIES / ORAL HEALTH / PRESCHOOL CHILDREN

KULLANANT PANSRIMANGKORN: FACTORS ASSOCIATED WITH DENTAL CARIES EXPERIENCE IN THAI PRESCHOOL CHILDREN WITH CEREBRAL PALSY ATTENDING NON-GOVERNMENTAL REHABILITATION CENTERS. ADVISOR: ASSOC. PROF. BUSAYARAT SANTIWONG, Ph.D., pp.

Objective: To investigate factors associated with dental caries experience in preschool children with cerebral palsy attending physical therapy programs in non-governmental rehabilitation centers in Bangkok.

Materials and Methods: This research is a cross sectional study of 60 children with cerebral palsy, aged 3-6 years, mean age 5.01 ± 1.23 years old. Dental caries experience was determined by dmfs index, numbers of surfaces of dental caries, extracted tooth, and filled tooth. The other variables were collected including: dental plaque index (OHI-S), type of cerebral palsy, frequency of carbohydrate intake events, dietary consistency, assisting with toothbrushing, and frequency of toothbrushing. Multiple linear regression analysis was carried out to test the relationships between risk factors and dental caries experience, significant level at $p < 0.05$.

Results: Dental caries experience in study group was 91.66%. The average decayed, missing, and filled surfaces (dmfs) were 20.30 ± 21.63 surfaces/individual. The multiple linear regression model indicated that dental caries experience was significantly associated with > 2 between meal carbohydrate food or beverages per day ($p = 0.003$) and spastic type of cerebral palsy ($p = 0.040$). No relationship was found with the other factors.

Conclusion: Dental caries experience of preschool children with cerebral palsy associated with frequency of carbohydrate between meals more than 2 times per day and the spastic type of CP.

Department:	Pediatric Dentistry	Student's Signature	.....
Field of Study:	Pediatric Dentistry	Advisor's Signature	.....
Academic Year:	2017		

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Best regards,

จุฬาลงกรณ์มหาวิทยาลัย
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CHAPTER I
INTRODUCTION

Background and Rationale

Cerebral palsy (CP) is the most common physical disability of children and occurs in 2-2.5 of 1000 live newborn.[1] CP caused by a defect or insult to the central nervous system occurred in the developing fetal or infant brain. Children with CP usually have several complications such as impairments of gross motor function, intellectual disability, failure to thrive, etc. [1, 2] Although, there are no national prevalence data of CP in Thailand, CP is still a major physical disability found in Thai children.The survey in Siriraj Hospital, Thailand, in the year 2011 found that CP was the most common neurological disorder (50%) in new pediatric patients attending at the department of rehabilitation medicine and the spastic type was the most common among these patients.[3]

Besides physical and intellectual function, this neuromuscular disorder also affects the oral health, masticatory disorders, limited self-cleansing function, food retention problems, bruxism and malocclusion.[4] Children with CP usually have high carbohydrates mashed food and most of them are dependent on caregivers for oral hygiene care.[5, 6] These factors can possibly increase risks of dental caries and periodontal disease in CP children.

Several studies[6-10] found that CP children presented higher dental caries experience including decay, extracted, and filled teeth, comparing to the non-disabled children. Some of these indicated that children with CP had greater dental caries experience since young age.[10] The higher caries experience in CP children was also noticed in developing Asian countries. Studies in India[11, 12], Bangladesh[13] and China[14] similarly found that the dental caries status children with CP was poorer compared with that of the normal children. Moreover, the unmet dental care need was noticed in the CP group.[7, 15, 16] These indicate the difficulties in accessing dental care of children who have this disability.

It was widely accepted that acidogenic microorganisms combine with frequent fermentable carbohydrate intake and susceptible tooth surface are main factors in dental caries.[17] In addition, some contributing factors are also related with development of dental caries.[18] Identifying these factors could lead to effective oral health promotion programs and practical dental caries prevention strategies. However,

there are few of studies which address the factors associated with dental caries in children with CP.

From previous studies, dental caries experience in children with CP was associated with several variables. The severe type of CP probably present higher risk of dental caries due to their profound involuntary reflex and difficulty to perform an adequate oral hygiene.[19] In the other hand, oral health behaviors in individuals with CP may also effect their dental caries status. Eating behaviors such as frequency of sugared foods and beverages intake and food consistency had been noticed as associated factors with dental caries in children with CP.[16, 20] Moreover, the relationship between dental caries and toothbrushing habits were also reported.[14, 21] Additionally, dental plaque accumulation, which is strongly associated with caries development,[22-24] may also determine caries risk in children with CP. However, up to present, no research has been developed to specify the associated factors with dental caries in Thai preschool children with CP.

The objective of this research was to investigate the factors affecting dental caries experience of Thai preschool children with CP attending physical therapy programs in 7 nongovernmental rehabilitation centers of the Foundation of Children with Disability (FCD), in Bangkok, Thailand.

Research Question

Are the factors including (1) Type of cerebral palsy, (2) frequency of between meal carbohydrate foods and beverages intake, (3) food consistency, (4) frequency of toothbrushing, (5) assisted brushing, and (6) dental plaque index associated with dental caries experience (dmfs) among Thai preschool children with CP attending the Foundation of Children with Disability (FCD), non-governmental rehabilitation center in Bangkok, Thailand.

Research Objective

This study is aimed to investigate the factors affecting of dental caries experience (dmfs) in Thai preschool children with CP, which are (1) Type of cerebral palsy, (2) frequency of between meal carbohydrate intake, (3) food consistency, (4) frequency of toothbrushing, (5) assisted brushing, and (6) dental plaque index.

Hypothesis

This study hypothesized that there is no association among type of cerebral palsy, frequency of between meal carbohydrate foods and beverages intake, food consistency, frequency of toothbrushing, assisted brushing, and dental plaque index in

dental caries experience in Thai preschool children with CP attending non-governmental rehabilitation center in Bangkok, Thailand.

Operational Definitions

Dental caries experience: The existence of one or more dental caries lesions (noncavitated and cavitated lesions), missing due to caries, or filled tooth surfaces (dmfs) in any primary tooth in a child of 71 months old or younger.

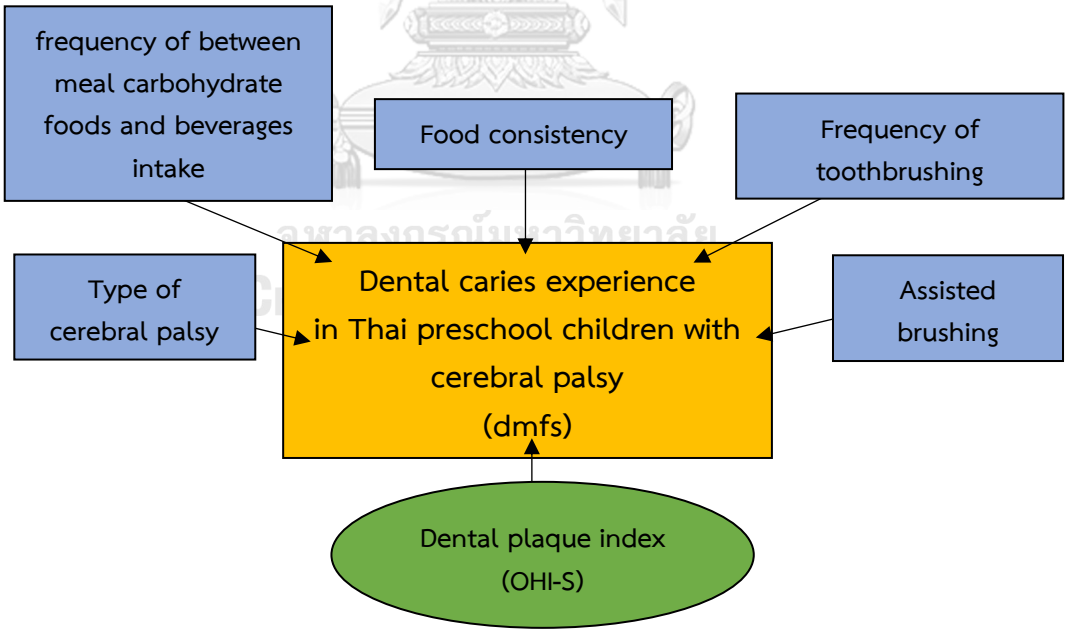
Non-governmental rehabilitation centers: 7 rehabilitation centers under the Foundation of Children with Disability (FCD). FCD is a nongovernmental center specializing in providing day care to children with disabilities in Bangkok, Thailand.

Oral health behaviors: Behaviors that refer to either oral health enhancing or oral health compromising behaviors namely frequency of between meal carbohydrate intake, food consistency, frequency of toothbrushing and assisted brushing

Preschool children: Thai children aged between 3-6 years old

Type of cerebral palsy: Classification of cerebral palsy according to predominant motor disorder, spastic type and non-spastic type.

Conceptual Framework



Scope of the Research

1.7.1 Population

Thai children with CP aged 3-6 years old who attend physical therapy programs in 7 centers the Foundation of Children with Disability (FCD), a non-governmental rehabilitation center, Bangkok, Thailand.

1.7.2 Sample

Thai Children with CP aged between 3–5 years old, attending physical therapy programs in 7 centers under the Foundation of Children with Disability (FCD) in Bangkok, Thailand during May 2017- March 2018. Children had completed primary dentition. Only the children that primary caregivers were in agreement would be included in the study.

1.7.3 Variables

The independent variables in the analysis were (1) type of cerebral palsy, (2) frequency of between meal carbohydrate foods and beverages intake, (3) food consistency, (4) frequency of toothbrushing, (5) assisted brushing, and (6) dental plaque index (OHI-S).

The dependent variables in the analysis was dental caries experience (dmfs index)

Research Design

Cross-sectional study

Limitations of the Research

Some limitations of this research are addressed as followings. The collections of data were considered limited to generalized the findings to the population of children with cerebral palsy. Moreover, oral health behaviors information collected by interviewing could be lacking of details from limitation of recall memories.

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Ethical Considerations

All procedures performed in studies involving human participants were approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (study code HREC-DCU 2017-017).

Expected Benefits

This research was aimed to identify factors influencing caries experience in primary dentition among young Thai children with CP. Future oral health preventive programs could be more effective as it is directly modified the dental caries associated factors in preschool children with CP attending in the rehabilitation centers in Bangkok.

Since it was lack of studies in dental caries associated factors in Thai CP patients. This research provides the information for possible causes of dental caries in preschool children with CP attending physical therapy programs in 7 centers under the

Foundation of Children with Disability (FCD) in Bangkok. Its data and descriptive literatures may be broadened into further studies.

Keywords

cerebral palsy, dental caries experience, oral health behaviors, preschool children

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CHAPTER II

REVIEW OF LITERATURES

In this research, the author has reviewed the previous documents and studies as followed.

1. Cerebral palsy

1.1 Causes of cerebral palsy

1.2 Classification of cerebral palsy

1.3 Oral health in patients with cerebral palsy

1.3.1 Oral hygiene

1.3.2 Dental caries

1.3.3 Gingivitis

1.3.4 Malocclusion

1.3.5 Bruxism

1.4 Access to dental care in children with cerebral palsy

2. Dental caries

2.1 Etiology of dental caries

3. Factors associated with dental caries in children with cerebral palsy

3.1 Type of cerebral palsy

3.2 Oral health behaviors

3.2.1 Dietary pattern

- frequency of between meal carbohydrate foods and beverages intake

- Food consistency

3.2.2 Oral hygiene practice

- Frequency of toothbrushing

- Assisted brushing

3.2 Dental plaque

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4. Clinical oral health assessment

4.1 Dental caries assessment

4.2 Dental plaque assessment

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1. Cerebral palsy

Cerebral palsy (CP) is the most common physical disability affecting the children's functional development. It is a non-progressive disorder of the development of movement and posture caused by a defect or insult to the central nervous system that occurred in the developing fetal or infant brain. The brain affected area is shown by the disabilities as a motor disorder, additional developmental disabilities, for instance, cognitive impairment and disturbances of sensation, communication, perception, and behavior. [1, 4]

The most recent definition of CP is the outcome of an International Workshop on definition and classification of CP was held in Bethesda, Maryland (USA), on July 2004, with support from United Cerebral Palsy Research and the National Institutes of Health and National Institute of Neurological Disorders and Stroke. The Workshop participants agreed on an update on definition of CP as follows[2]:

> *Cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to nonprogressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour, by epilepsy, and by secondary musculoskeletal problems.*

Birth prevalence rates for CP have been reported several times, the condition occurs in range of 2-2.5 of every 1000 live born children.[1] In a retrospective cohort study, Lang et al (2012) found that CP prevalence was 0.61 per 1000 in Thai infants who were born in California.[25] However, in Thailand, there was no national data about children with CP but there were a few reports of the epidemiology of children with CP in the university hospitals. The survey in Siriraj Hospital in the year 2011 found that CP was the most common neurological disorder (50%) in new patients attending at the department of rehabilitation medicine and the spastic type was the most common among these patients.[3] Similar to the study in Chulalongkorn memorial hospital, the spastic CP was the highest number of cases among pediatric patients attending the rehabilitation out-patient clinic during 1986-1996.[26] The current information shows that even now CP is a major physical disability found in Thai newborns.

1.1 Causes of cerebral palsy

CP was first described in 1862 by an English surgeon, William Little. He described the condition that the children have a disorder in developmental skill progression in a first year of life which connected of a lack of oxygen during birth. Over 100 years that birth asphyxia was thought to be the cause of CP. [1]

Currently, the biomedical studies found many conditions and risk factors in the period of prenatal, perinatal, or postnatal may associated with CP. The disorder occurs after some type of damage to the immature brain. This insult can initiate during the prenatal period through the first few years of life. The risk factors that connected in the development of CP are wide range.[1] (see Table 1)

Some cases of CP cannot be determined a certain cause. There are 30% of cases which have none known etiology. Congenital cause as a premature newborn (less than 32 weeks' gestation) with very low birth weight (less than 1500 g) have significant risk in development of CP.[27] However, birth complications are caused for only small cases of CP. It has been estimated that 80% of CP cases can be associated with prenatal factors.[4]

An early diagnosis from clinical observation and parental report leads to practical therapeutic interventions. The clinical presentation of CP can be seen in first 12 to 18 months of infant when children cannot reach their motor development milestones or when they have abnormal gross motor function or atypical muscle flexibility.[28] Children have no ability to sit up unassisted or delayed learning to walk. Parents may report difficult feeding, excessive crying and jitteriness. [1]

The diagnostic process requires the exclusion of other causes, such as neuropathy, metabolic disorder, genetic disorder that have a similar clinical manifestation. However, the definitive diagnosis can be made by using neuroimaging studies, electroencephalography, chromosomal studies and blood test. [29]

Table 1 Risk factors associated with cerebral palsy

Prenatal	Perinatal	Postnatal
▪ Hypoxia ▪ Genetic disorders ▪ Metabolic disorders ▪ Multiple gestation ▪ Intrauterine infection ▪ Thrombophillic disorders ▪ Teratogenic exposure ▪ Chorioamnionitis ▪ Matenal fever ▪ Exposure to toxins ▪ Malformation of brain structures ▪ Intrauterine growth restriction ▪ Abdominal trauma ▪ Vascular insults	▪ Premature birth <32 wk or <1500 g ▪ Asphyxia ▪ Blood incompatibility ▪ Infection ▪ Abnormal fetal presentation ▪ Placental abruption ▪ Instrument delivery	▪ Asphyxia ▪ Seizures in postnatal period ▪ Cerebral infarction ▪ Hyperbilirubinemia ▪ Sepsis ▪ Respiratory distress syndrome ▪ Chronic lung disease ▪ Meningitis ▪ Postnatal steroids ▪ Intraventricular hemorrhage ▪ Periventricular leukomalacia ▪ Shaken baby syndrome ▪ Head injury

1.2 Classification of cerebral palsy

There are many methods in classifying types of CP according to nature of the motor disorder, topographical features, and functional levels.

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1.2.1 Classified by motor disorders

One method to classify CP is described in the area of the brain that has been affected resulting in predominant motor disorder, it divides CP into two groups: pyramidal (spastic) and extra pyramidal (nonspastic).[1, 4]

1. Pyramidal or Spastic CP

   Approximately 70% to 80% of all cases of CP, pyramidal or spastic CP is developed from the brain's pyramidal (upper motor neuron) damage.

   Predominant features are increased muscle tone with hyperreflexia, clonus, extensor Babinski response, and persistent primitive reflexes are commonly seen.

2. Extrapyramidal or Non-Spastic CP

   Approximately 15% to 20% of all cases of CP, extrapyramidal or non-spastic CP is typically divided into two subtypes, dyskinetic and ataxic.

Dyskinetic CP, which accounts for 10% to 15% of all cases, is resulted from the defect in basal ganglia or deep motor neurons. This type of CP presented with motor characteristics including hypotonia, athetotic movements and abnormal postural control. Patients also have oromotor difficulties including speech and swallowing difficulties.

Ataxic CP, which were found only approximately 5% of cases, is caused by defect in cerebellar neurons. Patients have movement problems with voluntary gait, balance and depth perception.

1.2.2 Classified by topographical features

CP can also be classified by topographical pattern of limb involvement which characterized by the affected extremities as follow.[1, 4, 29]

1. Quadriplegia: involving all four extremities, the trunk, and oromotor musculature. This type shows for 10% to 15% of cases of spastic CP. These cases are at high risk for seizures and sensory impairments.
2. Diplegia: characterized by spasticity in the legs. This type shows for 30% to 40% of cases of spastic CP. This can affect arms but in a lesser scope. Approximately 50% of these patients are associated with preterm birth.
3. Hemiplegia: One side of the body is involved. This type shows 20% to 30% of cases of spastic CP. Normally, the arm is more effected than the leg. These patients have high risk in childhood's brain arteriovenous malformation and limited intraventricular hemorrhage.
4. Monoplegia: Only one arm or leg is involved. This condition is very rare. Patients often have an underlying etiology other than CP.

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Some of the patients have many different combinations of types of CP depending on the area of brain damage.

1.2.3 Classified by functional levels

The Gross Motor Function Classification System

The GMFCS[30] consist of five levels and five age bands: less than 2 years of age, 2 to 4 years of age, 4 to 6 years of age, 6 to 12 years of age and finally 12 to 18 years of age. Distinctions between age bands are based on functional limitations, the need for hand-held mobility devices (such as walkers, crutches, or canes) or wheeled mobility, and quality of movement that are thought to be meaningful in the daily lives

of children with CP. Emphasis is on children's usual performance in home, school, and community settings rather than the known capability of patients.

Table 2 Heading for each level of Gross Motor Function Classification System (GMFCS)

General heading for each level	
LEVEL I	Walks without Limitations
LEVEL II	Walks with Limitations
LEVEL III	Walks Using a Hand-Held Mobility Device
LEVEL IV	Self-Mobility with Limitations; May Use Powered Mobility
LEVEL V	Transported in a Manual Wheelchair

1.3 Oral health in patients with cerebral palsy

1.3.1 Oral hygiene

Individuals with CP usually have poor oral hygiene because of the limited of ability to maintain oral sanitation due to many conditions, such as dyskinetic movements, abnormal vomit reflexes and lack of ability to maintain the position. Most of them are dependent on caregiver to help them to do activities in daily life including toothbrushing. The oral hygiene program should be planed individually for each patient with appropriate positioning, brushing technique and devices which make the oral care more comfortable.[4]

Many studies showed that the oral hygiene of people with CP were inferiorly to those of people without CP. The study of Pope and Curzon (1991) showed that the oral hygiene of children with CP were worse than normal children.[15] Similar to the study of Dos Santos et al in 2003 which investigated oral conditions in children with CP, the research found that plaque index values were significantly higher in both sexes with permanent dentition in the study group ($P<0.05$). Besides the higher plaque index, residual food is also noted in the CP group.[7] Recently, Rennan et al (2010)[31] also found that preschool children with CP had higher plaque index scores ($P < 0.001$) than the children without CP.

Many strategies have been suggested to perform biofilm controlling in CP patients such as the special toothbrush designs[32, 33], and the use of chlorhexidine-containing toothpaste.[34] Although there was a recommendation to use the electrically powered toothbrush in CP patients and to define the optimum hygiene method[35], Lyrio Ferraz in 2015 compared the effectiveness of mechanical biofilm control methods and found that there was no significant difference between manual brushing and the electric toothbrush.[36]

1.3.2 Dental caries

The neuromuscular disorder in individuals with CP can significantly affect dental caries developing. Patients cannot control the movement of the tongue and facial muscle that diminish the oral self-cleansing function. Patients may have an issue of mastication and swallowing disorders with a prolonged time of intake of food and swallowing. Moreover, their typical diets are usually liquid and semisolid high sugar food that rich in carbohydrates. These conditions have been associated with increasing risk of dental caries.[6, 7]

There are several studies investigating caries experience in individuals with CP. In a 2003 Brazilian study, Dos Santos et al found that the children with CP have significantly higher decayed, missing, and filled tooth surfaces scores when compared with normal children.[7] Similar to study of Guare et al in 2003[10] which obtained a dmfs index for primary dentition in children with CP, the mean dental caries values were greater for the CP children when compared to the control group. In 2010, Rodrigues Santos[8] also found that children with CP had significantly higher in caries prevalence compared to normal children. In addition, the higher caries experience in CP children was noticed in developing Asian countries. Studies in India[11, 12], Bangladesh[13] and China[14] similarly found that the dental caries status children with CP was poorer compared with that of the normal children.

In contrary, Nielsen's study in 1990[37] found lower decayed, missing, and filled tooth surfaces scores in adolescents who had CP than in a control group. Pope and Curzon (1991) [15] also found that the levels of decayed, missing, and filled teeth between children who had CP and a control group are not significant different but the CP children had more extracted and untreated caries than the nondisabled children. Recently, according to a study in preschool children in 2010, Rennan et al found that There was no significant difference in the dental caries prevalence of the preschool children with and without CP.[31]

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1.3.3 Gingivitis

There are numbers of studies which reported the high prevalence of gingivitis in the children with CP.[7, 31, 38] Guare and Ciampioni (2004)[38] concluded that children with CP had greater numbers of periodontal disease in the primary dentition than normal children. They also found that children with spastic tetraparesis (quadriplegia) showed a higher mean gingival index than children with spastic hemiparesis. Rennan et al (2010) also found that preschool children with CP had higher gingival index scores ($p = 0.02$) than healthy children.[31]

1.3.4 Malocclusions

Several studies examined a tendency of Angle Class II malocclusion and significantly increased overjet and overbite which resulted in prominent maxillary incisors in population of CP patients.[7, 15, 39, 40] These can be attributed to orofacial muscle hypotonia, imbalance between perioral and intraoral muscles, with resultant anterior tongue posturing, a poor swallow function, and mouth breathing can affect the occurrence of malocclusion and anterior open bite.[40]

1.3.5 Bruxism

There are many reports of high prevalence of bruxism in CP. Ortega et al (2007)[41] compared the parafunctional habits in patients with CP, they found that the prevalence of bruxism is significantly higher in the individuals with CP than a group of nondisabled individuals. Similar to dos Santos's report in 2003[7], the article found bruxism was present in a significantly higher percentage of permanent dentition of CP in Brazil.

Some authors suggested that the characteristics of the central nervous system, behavioral patterns and occlusal interference are predisposing factors of bruxism in CP.[42, 43] In addition, this parafunction appears to be modulated by disturbances in the mechanism of the dopaminergic function.[42]

1.4 Access to dental care in children with cerebral palsy

Several studies have repeatedly confirmed that the population of persons with disability have difficulties in access to dental care. Newacheck (2000)[44] revealed that oral health care was the most prevalent unmet health care needs for children with disabilities. Kenney et al (2008)[45] compared the parental report in preventive dental care use and oral health status between children with and without special health care needs. The researcher found that more parents of children with special health care needs reported unmet preventive dental care needs compared with normal children. Recently, Du et al (2014)[46] also found that preschool children with CP were less likely to have ever attended a dentist than normal children.

According to dental attendance, only few studies reported favorable percentage of dental care accessing in CP patients. In Northern Irish study, Russell and Kinirons (1992)[47] found that 60% of patients with CP aged 16-50 years have regular dental attendance, most of them attended the general dental services equally to the community dental services. However, in a 2011 survey, Nelson et al (2011)[48] reported that children with CP had more aversions to comprehensive dental treatment, prone

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to complications posed by their conditions, and more difficulty finding a dental personal willing to offer care. Also, children have high number of barriers to dental care due to fear and anxiety[47],a child's complicated condition and difficulties to find a dentist willing to treat them.[48]

2. Dental caries

Dental caries is the most common chronic infectious disease in oral of childhood. Dental caries caused by the interaction between bacteria, mainly Streptococcus mutans, and sugary components on tooth enamel. These bacteria break down sugars for energy, causing a low pH environment in the oral cavity and result in demineralization of the enamel of the teeth.

2.1 Etiology of dental caries

The biological mechanisms of dental caries are well known. It is a disease with a number of important etiological factors, which majorly are fermentable carbohydrates, cariogenic microorganisms and susceptible tooth surface. However, early childhood caries appears to be a particularly aggressive form of dental caries causing rapidly extensive destruction of the primary teeth.[49] This may be due to extremes in one or more of the factors or involve with further determinants.

A consumption of sugary and carbohydrate food is one of the well-known risk factors for the development of dental caries. Unlike others, sucrose is the most cariogenic sugar because it can form glucan that enables firm bacterial adhesion to teeth and limits diffusion of acid and buffers in the plaque.[50]

It now appears that the frequency of sucrose consumption is more important than the total amount intake. A review of the role of substrate in early childhood caries by Reisine and Douglass (1998)[51] found that the total weight of sugar in children's food and drink was not predictive of dental caries but the frequency of sugar intake shows an association with caries. Llena and Former (2008)[52] analyzed the association between caries experience and the consumption of cariogenic foods in a population of children. The result showed that the higher intake of foods containing starch and sugar in between meals was significantly associated with a greater incidence of caries.

There are strong evidences that mutans streptococci (MS) is involved in the development of caries in primary teeth have been reported.[53] The study of colonization of Mutans Streptococci in 8 to 15 month-old Children by Karn et al (1998) found an evidence that MS colonization could be seen as early as 10 months of age.[54] A correlation between an increasing percentage of children colonized with increasing age was observed. The study in children 6 to 36 months old by Milgrom et al (2000)

found that children with a high level of MS in dental plaque detected were 5 times more likely to have dental caries than children with a lower level of MS detected.[55] As the high concentration of MS, the present of dental plaque may effectively indicate the risk of caries in children. in the previous study by Alaluusua (1994) which suggest that visible plaque on the labial surfaces of maxillary incisors is the best indicator of caries development in young children with 92% specificity.[22]

In many infants, a combination of recently erupted immature enamel which is most susceptible to caries in an environment of cariogenic bacteria with frequent consumption of fermentable carbohydrates would render teeth particularly susceptible to caries. Moreover, a developmental defects of the tooth surface provides less resistance to acid attack.[53] Lai et al (1997) had found a significant association of enamel defects with dental caries in the very-low birthweight, preterm children. The researcher also concluded that enamel hypoplasia and opacity were significantly associated with dental caries in young children.[56] Milgrom et al (2000) also found that children with hypoplasia have 9.6 times greater of having any white spot lesions or enamel cavitation than children without any tooth defect.[55]

3. Factors associated with dental caries in children with cerebral palsy

3.1 Type of cerebral palsy

The association between type of CP and dental caries experience had been reported by Dos Santos et al in 2005. The authors found a high difference between the mean DMF scores for the groups with spastic quadriplegia and another group of CP. They concluded that the presence of higher risk of oral disease is found in group of severe neurological damage due to the difficulty to perform an adequate oral hygiene[19].

In contrast, the study of De Camargo and Antunes (2008)[16] found that nonspastic children with CP did not have a better dental conditions than the others with spastic CP and the children with spastic tetraparesis (quadriplegia) which represents a further level of physical limitation were not associated with worse oral health. Similar to the study by Diniz et al in 2015 which evaluate the association of the classification of CP on the caries experience in children and adolescents, they concluded that the CP classification had no influence on caries experience in these individuals.[57]

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3.2 Oral health behaviors

Health behaviors have been determined in several ways. Gochman (1988), in "Health Behavior Emerging Research Perspectives", has defined term 'Health behaviors' as behavior patterns, actions, and habits from personal traits such as beliefs, expectations, motives, values, perceptions and other cognitive elements to maintain ,restore and improve health.[58] Similar to Conner and Norman (1996) that referring Health behaviors refers to the activities undertaken for preventing disease or improving health and well-being.[59] This definition of behaviors consists health service utility, compliance with medical regimens, and personal health related behaviors.

In similar, oral health behaviors is a multidimensional phenomenon influenced by individual diversity, attitudes, experiences, and recognized risks and benefits. These are determined principally by the social opportunity structure offered by a society, which underlies the distribution of access to knowledge about oral health, the availability and utilization of dental services and the provision of the necessary funding. In general, the term "oral health behavior" describes the complex effect on individual oral health of oral hygiene habits, nutritional preferences and the pattern of a person's utilization of dental services.[60]

Some studies investigating the caries experience in children with CP have shown more severity in developing dental caries than that of normal children.[6-9] The problems are mainly resulted from difficulty in maintain oral hygiene caused by abnormal muscle control. having a high frequency of carbohydrate foods intake, using sugar-contained drugs. However, there are limited of studies describing to oral health behaviors among these group of patients.

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3.2.1 Dietary pattern

The eating behavior also has a direct effect on overall health in individual with CP. The relationship between eating or feeding pattern with the severity of lower body mass index, oropharyngeal dysphagia, gross motor function, and normal growth were recently examined.[61, 62] However, there are few studies investigate the associations of dietary pattern in CP patients and caries severity. Some studies showed the poor dietary habits in mentally and physically handicapped children that effect the oral health. Liu et al (2010)[21] had analyzed the impact of dietary habits to dental caries in 535 special school children with disabilities in Taiwan. The researcher found that 37% of the sample who received sugary foods as a reward for behavior control showed statistically significantly higher dt, DT, dmft, DMFT and caries prevalence compared to those children who did not receive sweets.

Frequency of between meal carbohydrate foods and beverages intake

One study showed the association between a consumption of cariogenic foods and caries experience in a population of children with CP. In a cross-sectional assessment of 200 children and adolescents with CP in Brazil by De camargo and Antunes (2007), the researcher found that the high frequency of sugared foods and beverages intake (more than three daily events of sugar intake) was the most significant behavioral characteristics associated with the prevalence of untreated caries in deciduous or permanent teeth in children with CP.[16]

Food consistency

Food consistency is the factor that may affect caries development. Individuals with CP who have severe oromotor impairments are frequently unable to consume solid food that leads to exclusive feeding with liquid or semisolid diet. Liquid food has more cariogenic potential, due to the addition of carbohydrate-based supplements. Frequency of exposure differs with each physical consistency; a liquid diet is digested more quicker and so is consumed more frequently.[63] Santos et al (2009)[20] noticed that children with CP who were severely impairments were more likely to be given a higher liquid diet which had a statistically significantly higher DMF and D values ($p<0.05$) compared to those on semisolid and solid diets. In similar to the Saudi Arabian study, Bakry and Alaki (2012)[64] had found a significant association between soft diet intake and caries experience in children with intellectual disabilities. However, there was no significant associations were found with type of feeding.

3.2.2 Oral hygiene habits

Oral hygiene habits are intrinsically related on caries experience. According to Roberto et al in 2012[65], oral hygiene is the main predisposing factor in the development of dental caries in children with CP. Patients may exhibit undesirable oral hygiene due to lacking the level of motor skills for routine cleaning of the oral cavity. In addition to these limitations in personal skills, caregivers of cerebral palsy patients also experience difficulties in maintaining satisfactory oral hygiene in these children. Such patients are often uncapable to follow hygiene instructions or understand the importance of maintaining satisfactory oral hygiene.

Frequency of toothbrushing

Toothbrushing is known as behavior for maintenance of oral health and brushing twice a day has become a normal consideration. A Cochrane review indicate that brushing twice daily decreasing caries increment by increases the effectiveness of

fluoridated toothpaste.[66] However, the effect of toothbrushing frequency on association with dental caries is unclear.

The association of brushing frequency and dental caries experience in children with disabilities had been reported, in Taiwanese study, Liu et al (2010)[21] found that children who brushed their teeth less than three times daily had higher dental caries indices as compared to those children with disabilities brushed their teeth more than three times a day. More recently, a study in Guangzhou, China, Liu et al (2014) also reported that frequency of toothbrusing (≤1 time per day) significantly affecting the development of dental caries in children with intellectual disabilities.[14]

Chu and Lo (2010)[67] found that 77% of Chinese teenagers with CP brush their teeth more than one a time daily. However, they reported no significant associated between the frequency of brushing and caries experience in this group of children.

Assisted brushing

Regarding to the ability to brush, Liu[21] also found that children with profound level of disability had a higher percentage (67.3%) in parental teeth brushing and they had a fewer caries prevalence, lower plaque score and more healthy gingival score, compared to those children with mild to moderate severity in disability which had a higher percentage (81.6%) in teeth brushing by themselves and with poor dental health.

Nevertheless, Chu and Lo[67] found that although almost half (45%) of the Chinese teenagers with CP receive parental assistance in tooth brushing, their oral health is still unsatisfactory. In addition, there were no significant differences in caries experience with individuals who brush themselves.

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3.3 Dental plaque

Dental plaque is an example of biofilm with a diverse microbial composition. Dental caries is the result from an increased numbers of acid-producing and acid-tolerating species, such as mutans streptococci and Lactobacilli which participate in demineralization.

Dental plaque accumulation and poor oral hygiene score significantly increased the children's risk of developing caries in various ages. Shabani et al (2014)[24] who studied in Kosovo, concluded that there is a strong correlation between DMFT and the simplified oral hygiene index (OHI-S) (Greene and Vermillion, 1964) in children 10-15 years old. One Nigerian study in 2009[23], investigated the association between dental plaque index and dmft in preschool children. The researchers found that every unit

increase in OHI-S, the child's odds for developing caries increased by 64% ($p < 0.000$).

Several studies showed that individuals with CP have greater dental plaque indices and a higher dental plaque accumulation level than healthy individuals.[7, 15, 68] The poor oral clearance ability caused by difficulty in movement control on activities of daily living, including personal and oral hygiene which leads to the higher risk of dental caries development. Roberto et al (2012) investigated factors associated with caries experience in the primary dentition in children with CP. They found that oral hygiene was the only variable that showed a statistically significant association with caries experience.[65] Dos Santos (2003)[7] also emphasized that accumulation of food deposits associated with the increased plaque index observed in the children with CP were high risk factors for the increase in caries prevalence in these patients.

In the aspect of biological factors, a 2002 Brazilian study examined the oral health status and the microbiological parameters associated with dental caries in 62 children with CP.[5] The researcher found that children with CP had significantly higher caries prevalence than the control group. They also found a significant correlation between the levels of S. mutans and plaque index of the study group, representing large numbers of cariogenic bacteria in dental plaque of these subjects.

4. Clinical oral health assessment

4.1 Dental caries assessment

Dental caries assessment in oral health surveys care conducted to obtain information about the prevalence of caries lesion in population, with the aim of planning oral health programs and policies. The assessment is mainly carrying out by visual examination. This method presented an acceptable accuracy and high value for specificity. It is simple with no need for an adjunct method or require no additional cost.[69] However, Caries assessment using visual inspection has presented low sensitivity particularly in discriminating cavitated lesions and non-cavitated early lesions. It is also depended on subjective nature, therefore, examiners can perform incongruity in the interpretation of clinical finding of carious lesion.[70]

Several sets of criteria have been presented for assessing dental caries. There are systems widely used in the surveys such as the standard World Health Organization (WHO) criteria and the International Caries Detection and Assessment System (ICDAS-II).

4.1.1 World Health Organization (WHO) criteria

WHO system is widely used for caries assessment in clinical practice and oral health surveys. This system has well designed procedure and recording pattern which could been used practically. Permanent dentition status is recorded using numbered scores (0-9) and the primary dentition status is recorded using letter scores (A-G) to define the tooth status. The examination should be conducted with a plane mouth mirror and a metal CPI probe. The use of radiography for detection of approximal caries is not recommended.[71]

Caries detection with WHO criteria has been performed at cavitation level, therefore, it has less sensitivity of caries epidemiology in populations with initial caries.[72]

4.1.2 International Caries Detection and Assessment System (ICDAS-II)

ICDAS dental caries criteria was developed for the purpose in clinical study, clinical practice and for epidemiological research. It has been proposed with visual examination, describing six stages of caries level, varying from non-cavitated lesion in enamel to apparent cavitation in dentin.

Ismail et al (2007) has discussed the data on discriminate validity and reliability of the ICDAS system, the researcher concluded that the criteria meet the requirements of validity and reliability. It has been proved to be reliable in indicating dental caries on pits and fissure and coronal surfaces even when performed by inexperienced dental examiners.[73] However, ICDAS system is less validity in detecting caries on smooth approximal surfaces. In primary teeth, the conclusion of the study in 2009, Shoaib et al (2009) found that both of validity and reproducibility of the ICDAS were acceptable when applied in primary molar teeth.[74]

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4.1.3 Dental caries diagnostic criteria in primary teeth

Warren et al (2002) developed specific diagnostic criteria for dental caries in the primary teeth, which classify lesions as non-cavitated lesions and cavitated lesions.[75] (Table 3)

The non-cavitated lesion (d1) include well defined margin chalky white spot lesion in smooth surface adjacent to the gingival margin with no evidence of clinical enamel broken and lightly stained or chalky white area adjacent to pit or fissure, intact surface with no undermined caries.

The cavitated lesion (d2) are usually found as obvious loss of enamel which usually have chalky white appearance along the cavity with the darker center, the

cavitated area can be examined either with visual inspection, the undermined caries beneath the enamel and using explorer for detection the surface tactile.

Table 3 Dental caries diagnostic criteria in primary teeth by Warren et al (2002)

	Non-cavitated lesion(d1)	Cavitated lesion(d2)
<u>Smooth surfaces</u>		
Appearance/color	Chalky white	Chalky white with darker
Surface	Intact	center
Tactile	Normal	Definite loss of tooth
Location	Usually adjacent to soft	structure
	tissue margin	Soft
		Usually adjacent to soft tissue
		margin
<u>Pits and fissures</u>		
Appearance and	May be lightly stained, or	Often stained light to dark
color	have chalky white area	brown and often with chalky
	adjacent to pit or fissure	white area adjacent
	Intact	Definite loss of tooth
Surface	Normal	structure
Tactile	Not present	Soft
Undermining		Often evident

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4.2 Dental plaque assessment

Dental plaque index which usually score of the number of dental plaque accumulated areas of teeth examined is the most common method for evaluate individual's oral hygiene status. There are several indices determine the oral hygiene in children. The examination includes that are based on visible biofilm, running an explorer along the surfaces of the teeth and the use of disclosing solution.

4.2.1 Oral Hygiene Index (Greene and Vermillion)[76]

The original twelve tooth surfaces plaque index was subsequently reduced to six tooth surfaces as known as "simplified Oral Hygiene Index" or OHI-S, Greene and Vermillion's oral hygiene index has high precision for assessing the oral hygiene of population groups. It measures the amount of dental plaque and debris on the labial surfaces and lingual surface of six selected teeth.[77]

The index of the individual can be obtained by adding numbers of teeth and dividing by the number of teeth examined. According to Oliveira Guare and Ciampioni (2004)[38], in the study of the prevalence of periodontal disease in the primary dentition of children with CP. The status of oral hygiene in young CP patients was evaluated by simplified Oral Hygiene Index (OHI-S) recorded from 4 selected teeth ; upper right first molar (54); upper left central incisor (61); lower left second molar (75); and lower right lateral incisor (82).

Other study used more numbers of index teeth. In 2010's study of oral health in preschool children with CP, Rennan et al[31] chose 6 index teeth: upper right second molar (55); upper right central incisor (51); upper left first molar (64); lower left second molar (75); lower left central incisor (71); lower right first molar (84) for the assessment of Oral Hygiene Index (OHI-S) and the Gingival Index.

When the specific teeth were not possible due to extraction, caries, or restoration, they were substituted by the subsequent element. Scores for dental plaque range from 0 to 3, according to the following criteria:

0 No debris or stain present

1 Soft debris covering not more than one third of the tooth surface being examined or the presence of extrinsic stains without debris regardless of surface area covered.

2 Soft debris covering more than one third but not more than two thirds of the exposed tooth surface.

3 Soft debris covering more than two thirds of the exposed tooth surface.

This assessment is simple and reproducible. It was claimed for accurately representing the oral hygiene status of the whole mouth.[76]

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4.2.2 Plaque Index (Silness and Loe)[78]

Silness and Loe's plaque index system has evaluated the thickness of soft debris and mineralized deposits at the gingival margin of the teeth. This index scored the thickness of dental plaque at the distal-facial, facial, mesial-facial, and lingual surfaces of each tooth, the criteria range from no visible plaque to the abundance of soft debris within the gingival pocket. The examiner can use the index for all or selected teeth and no need for disclosing solution.

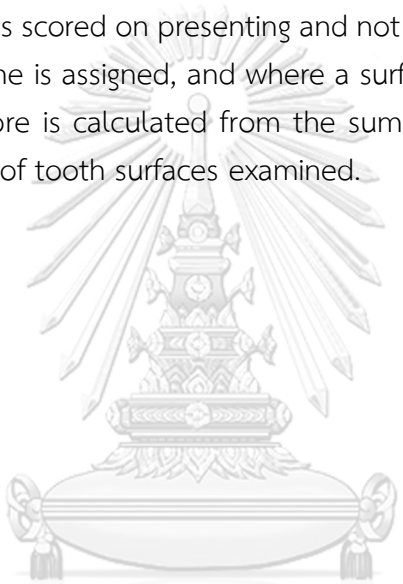
4.2.3 Plaque Control Record (O'Leary, Drake and Naylor)[79]

O'Leary et al proposed a method for evaluating oral hygiene of the individual. The index has recorded the disclosed plaque accumulation in the dentogingival junction of the tooth surfaces (mesial, distal, facial, lingual) of all teeth. The number

of marked units is divided by the total number of tooth surfaces examined, and the result is multiplied by 100 to show the index as a percentage. This system has allowed the patient to consider his own oral hygiene status which make a benefit for motivation on patients

4.2.4 Patient Hygiene Performance Index (PHP, Podshadley and Haley)[80]

PHP was developed to evaluate individual' oral hygiene performance by assessing the debris on each surface which divided into five sections. The clinical crown is subdivided longitudinally into mesial, middle, and distal thirds. The middle third is subdivided horizontally into the gingival, middle, and occlusal thirds. Within each surface area the debris is scored on presenting and not presenting, where if any debris is present, a score of one is assigned, and where a surface is free of debris a score of 0 is given. The PHP score is calculated from the sum of the score for each surface divided by the number of tooth surfaces examined.



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CHAPTER III

MEDTHODOLOGY

1. Population

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1. Population

1.1 Population

Thai children with CP aged 3-6 years old who attend physical therapy programs in centers the Foundation of Children with Disability (FCD), a non-governmental rehabilitation center, Bangkok, Thailand.

1.2 Study population

The study population was selected from children attending physical therapy programs in rehabilitation centers of the Foundation of Children with Disability (FCD) in Bangkok, during May 2017- March 2018. The centers consisted of Bang Khae center, Bang Phlat center, Khlong San center, Min Buri center, Sai mai center, Saphan Sung center, and Wang Thonglang center One center (On Nut center) which not in operation in the study period was excluded from the study. The total of 7 centers enrolled in the study were showed in Figure 1.

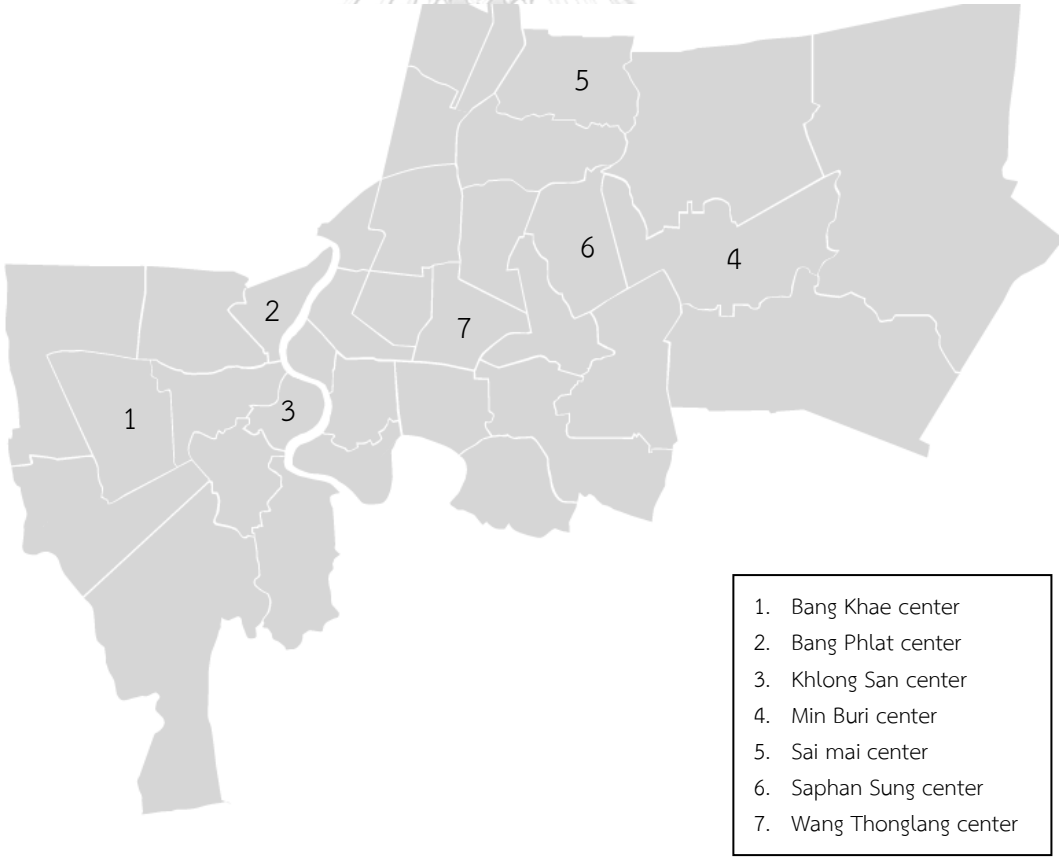

Figure 1 The location of enrolled rehabilitation centers of the Foundation of Children with Disability (FCD) in Bangkok

Inclusion criteria

1. Children with diagnosis of any type of CP instituted in Foundation of children with disability, Bangkok, Thailand.
2. Aged 3-6 years old.
3. Completed primary dentition.
4. Their primary caregivers were in agreement into the study.
5. Their primary caregivers were capable to answer the questionnaire.

Exclusion criteria

1. Children whose primary caregivers refused consent to the study.
2. Children who did not have engaged primary caregivers.
3. Children who were exclusively fed by gastrostomy tube insertion.

Sample size

Sample size was calculated from Heinrich-Heine-Universität's GPower3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) which is a stand-alone power analysis program for statistical tests. The model of F test: Multiple Regression (deviation of R2 form zero) will be used.

- According to Mutarai (2008)[81], oral health behaviors influencing caries experience in primary dentition of Thai children with cleft lip and/or cleft palate (coefficient of determination: 0.32)
- Number of predictors: 6
- Significant level: 0.05
- Power: 0.95

From the analysis, 52 children were required in this study. Considering a drop-out rate of 10%, total sample size is 57.

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2. Variables

2.1 Dependent variable

The dependent variable in the analysis was dental caries experience recorded in primary dentition used the dmfs index.

Table 4 Dental caries experience (dmfs index)

Code	Definitions
d	Carious tooth (non-cavitated lesion and cavitated lesion), restored tooth with secondary caries, retained root, temporary filling, restored tooth surface with other carious surfaces
m	Previously extracted teeth due to caries
f	Restored teeth due to caries. Teeth were considered restored without decay when one or more permanent restorations were present and there was no secondary caries or other area of the tooth with primary caries. A tooth with a crown placed because of previous dental caries was recorded in this category
S	Recording was counted as surface

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2.2 Independent variables

2.2.1 Type of cerebral palsy

Type of cerebral palsy was assessed according to predominant motor disorder as spastic type and non-spastic type.

Table 5 The independent variables: type of cerebral palsy

Factors	Variables	Definitions
Type of cerebral palsy	Spastic	Increased muscle tone with hyperreflexia, clonus, extensor Babinski response, and persistent primitive reflexes
	Non-spastic	Hypotonia, athetotic movements and abnormal postural control

2.2.2 Oral health behaviors

Oral health behaviors refer to dietary pattern, which were frequency of between meal carbohydrate foods and beverages intake, and food consistency. The oral hygiene habits which were assisted brushing, and frequency of toothbrushing.

Table 6 The independent variables: dietary pattern

Factors	Variables	Definitions
Frequency of between meal carbohydrate foods and beverages intake	High	Child has >3 between meal carbohydrate intake
	Low	Child has ≤3 between meal carbohydrate intake
Food consistency	Liquid food	Food must be homogeneous, smooth, and without chunks. This consistency is obtained through mixing, beating, or blending food with the use of a blender.
	Solid and Semi solid food	Semisolid food with a paste-like consistency, but with pieces of crushed, kneaded or triturated foods. or Solid food which normally offered to healthy individuals and consists of food pieces that need to be chewed.

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Table 7 The independent variables: oral hygiene habits

Factors	Variables	Definitions
Assisted brushing	Assisted	The patients brush their teeth assisted by parents/caregivers
	Not assisted	The patients brush their teeth themselves
Frequency of brushing	<2	Brush their teeth less than 2 times daily
	≥2	Brush their teeth 2 times daily or more

2.2.1 Dental plaque index

Dental plaque assessment in this study will be performed according to Greene and Vermillion's Simplified Oral Hygiene Index (OHI-S).[76] The index consists of dental plaque records from 6 index teeth and divided the total score by 6. The final score would be 0-3.

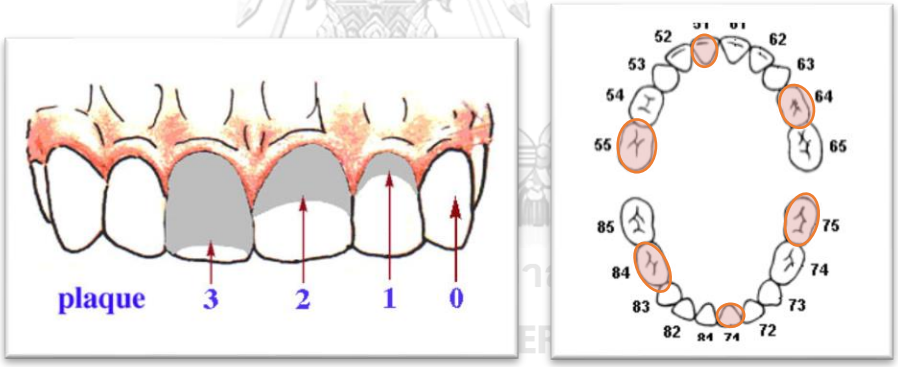

Figure 2 Greene and Vermillion's Simplified Oral Hygiene Index (OHI-S) and 6 index teeth

The presence of dental plaque was categorized in visible plaque accumulation (OHI-S score ≥ 2) or non-visible accumulation (OHI-S score < 2).

Table 8 The independent variables: dental plaque Index

Factors	Variables	Definitions
Dental plaque Index	Non-visible plaque accumulation	OHI-S score < 2
	Visible plaque accumulation	OHI-S score < 2

3. Data collection

The data were collected from clinical oral health examination including assessment of dental caries and dental plaque. Interviewing with structured questionnaire was also performed. One trained and calibrated dentist (Cohen Kappa = 0.80) was designated as examiner and interview conductor.

3.1 Medical record

The medical history of children were examined by dentist. The type of cerebral palsy and severity of medical status were carried out using information collected from health charts that were obtained from the Foundation of Children with Disability.

3.2 Questionnaire

The structured questionnaire was designed for interviewing with primary caregivers. They answered detailed questionnaires including children' s demographic data, children' s oral health behaviors in aspect of dental service utilization, oral hygiene practice, dietary pattern and primary caregiver' s socio- demographic information. All interviews were performed by one dentist.

Topics	Question number
Part 1 General information of child	
Gender	Q1
Date of birth	Q2
Birthweight and Current weight	Q3
Family information	Q4-6
Medication used	Q7
School attendance	Q8
Part 2 Dental service utilization	Q11-15
Part 3 Oral hygiene practice	Q16-22
Part 4 Dietary pattern	Q23
Part 5 Primary caregiver information	Q24-30

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3.3 Clinical oral health assessment

The oral examination of this study included assessment of: (1) dental caries assessment, and (2) dental plaque assessment. All assessments were conducted by one dentist using an examination kit containing a mouth mirror, CPI probe with a 0.5-

mm ball tip, cotton rolls, gauzes and a mouth gag. The examination was set under LED light torch. No radiographic examination would be performed.

3.3.1 Dental caries assessment

Dental caries assessment, according to the criteria of the principles and methods endorsed by the 2013 World Health Organization (WHO)[71], describing the decayed, missing, and filled surfaces (dmfs) for primary teeth. The decayed surfaces recorded as Warren et al (2002)'s examination criteria for dental caries in primary dentition which classify lesions as non-cavitated lesion (d1) and cavitated lesion (d2).[75] The tooth surfaces (4 surfaces in anterior tooth, 5 surfaces in posterior tooth) will be recorded with codes as followed.

0 Sound tooth
1 Non-cavitated lesion (d1)
2 Cavitated lesion (d2)
3 Restoration with secondary caries, temporary restoration
4 Restoration without secondary caries
5 Extracted tooth due to caries

3.3.2 Dental plaque assessment

Dental plaque will be examined with CPI probe without disclosing dye. The dental plaque assessment was modified from Greene and Vermillion's simplified Oral Hygiene Index" (OHI-S).[76] The examiner will run the probe gently along the surface of the tooth from the occlusal/incisal up to the gingiva. The examiner will analyze the dental plaque attached on the tip of probe. Record the sum of dental plaque score in surfaces with codes (0,1,2,3) for 6 index teeth: upper right second molar (buccal surface); upper right central incisor (labial surface); upper left first molar (buccal surface); lower left second molar (lingual surface); lower left central incisor (labial surface); lower right first molar (lingual surface). Then, divided the total score by 6. The final score would be 0-3. The presence of dental plaque was categorized in visible plaque accumulation (OHI-S score ≥ 2) or non-visible accumulation (OHI-S score < 2).

3.4 Frequency of between meal carbohydrate foods and beverages intake

Data of foods and beverages intake of individuals were obtained from three-day food records which listed by primary caregivers. The record including 2 weekdays and 1 weekend, recording dates were determined by dentist. The instruction

of food recording was given to primary caregivers, assigned to return the records via mobile application.

After data analyzing, the child's oral health report and recommendation will be presented to primary caregivers.

4. Data quality control procedures

Validity of questionnaire

The content validity of structure questionnaire was examined by experts in pediatric dentistry. The questionnaire was designed according to factors possibly associated with dental caries experience in children with CP which conforming to the literatures review.

In order to minimize the chance of misunderstanding and misinterpretation, trials of the questionnaire survey were performed on 10 primary caregivers of children with different educational backgrounds. The clarity of the questions will be checked and edited.

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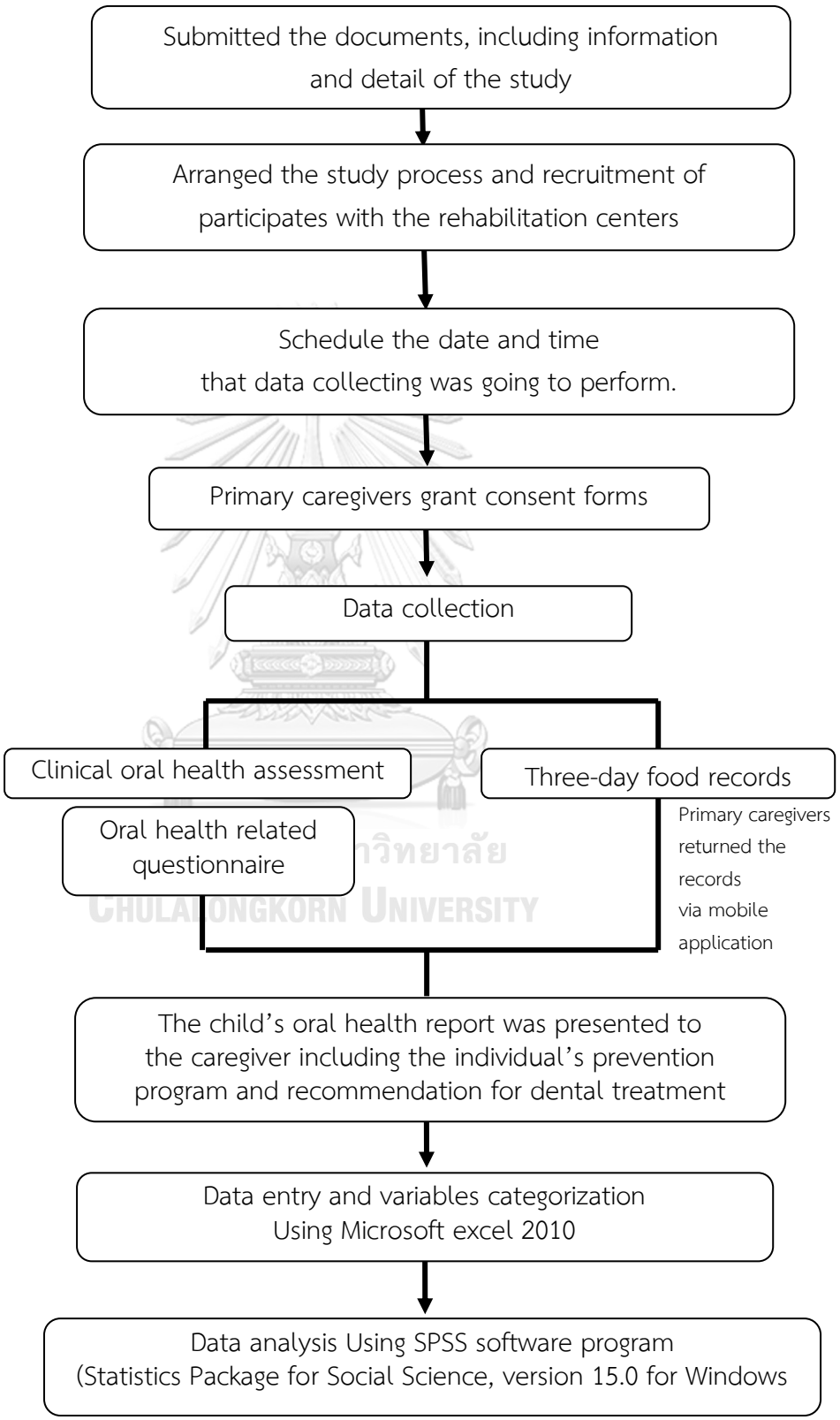
5. Study process



6. Data analysis

6.1 Descriptive statistics

Descriptive statistics will be used to analyze variation as follows.

a. Demographic data

Age
Gender
Medication used
School attendance
Type of CP
Functional level
Socioeconomic characteristics

b. Oral health status

Dental caries status
Oral hygiene status

c. Oral health behaviors

Frequency of between meal carbohydrate foods and beverages intake
Food consistency
Assisted brushing
Frequency of brushing
Regularity of dental service utilization

Data of categorical variables were presented in frequency distributions and percentages. The numerical variables will be presented as mean values and standard deviation.

6.2 Inferential statistics

The associations of 6 independent variables (type of CP, frequency of between meal carbohydrate foods and beverages intake, food consistency, assisted brushing, frequency of toothbrushing, and dental plaque index), and caries experience (dmfs) were considered in bivariate analysis using Mann-Whitney U Test and simple linear regression. Any independent variables which are significantly ($p<0.05$) related with dmfs in the bivariate analysis were considered into the multiple linear regression model. The selected variables were entered to the model in a forward stepwise process to evaluate the final factors which associated with dental caries experience (dmfs) in the sample. The regression coefficient (β) with 95% confidence interval (95% CI) of each variable were presented. The data will be analyzed by using SPSS software program (Statistics Package for Social Science, version 15.0 for Windows). The level of statistical significance will set at $p < 0.05$

CHAPTER IV
RESULTS

This study was conducted in Thai children with CP aged 3-6 years old who attend physical therapy programs in 7 centers the Foundation of children with disability (FCD), a non-governmental rehabilitation center, Bangkok, Thailand. The aim of the study was to investigate the association between dental caries experience (dmfs) in children with CP and independent variables, which were (1) type of cerebral palsy, (2) frequency of between meal carbohydrate foods and beverages intake, (3) food consistency, (4) frequency of toothbrushing, (5) assisted brushing, and (6) dental plaque index (OHI-S).

The data collection included clinical oral health assessment, interviewing of children's general information and oral health related questionnaire, and three-days food records which reported by caregivers. Data of the recent study are presented in the list below.

1. Information of participants and their attended rehabilitation centers
2. General information of participants
3. Oral health assessment of participants
    - 3.1. Dental caries experience (dmfs)
    - 3.2. Dental plaque index (OHI-S)
4. Factor associated with dental caries experience in participants
    - 4.1. Type of cerebral palsy
    - 4.2. Frequency of between meal carbohydrate foods and beverages intake
    - 4.3. Food consistency
    - 4.4. Frequency of toothbrushing
    - 4.5. Assisted brushing
    - 4.6. Dental plaque index.
5. The Analysis of factors associated with dental caries experience by multiple linear regression

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1. Information of participants and their attended rehabilitation centers

The population in this study was Thai children with CP aged 3-6 years old who attend physical therapy programs in 7 centers the Foundation of children with disability (FCD). The rehabilitation centers consisted of Bang Khae center, Bang Phlat center, Khlong San center, Min Buri center, Sai mai center, Saphan Sung center, and Wang Thonglang center.

Inclusion criteria of the study sample is children with completed primary dentition, children of primary caregivers are in agreement into the study and capable to answer the questionnaire. Exclusion criteria is children who do not have engaged primary caregivers and children who were exclusively fed by gastrostomy tube insertion.

A total number of CP children aged 3-6 years old who attended in the rehabilitation centers was 71. Five children were fed by tube insertion and were excluded from the study. The CP children who met the inclusion criteria comprised 66 samples. From these group of children, there were 4 children who unable to schedule an appointment and 2 children whose primary caregivers declined to join the study. Resulted in 60 eligible participants were enrolled in the study with a recruitment rate of 90.90%.

Table 9 Information of participants according to rehabilitation centers

Rehabilitation centers	Male	Female	Total
Bang Khae	1	6	7
Bang Phlat	1	4	5
Khlong San	2	3	5
Min Buri	6	17	23
Sai mai	2	4	6
Saphan Sung	5	2	7
Wang Thonglang	5	2	7
Total	**22**	**38**	**60**

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2. General information of participants

The total number of study sample was 60, consisted of 22 boys and 38 girls. The mean age of the study sample was 5.01 ± 1.23 years. The characteristics of participants were showed in (Table 10).

Table 10 The characteristics of participants

Characteristics		Mean ± (SD)	N (%)
Demographics data			
Age (years)		5.01 ± 1.23	
Gender	Male		22 (36.67%)
	Female		38 (63.33%)
School attendance			
	Yes		20 (33.33%)
	No		40 (66.67%)
Socioeconomic status			
Primary caregiver's educational level			
	9^{th} grade or under		35 (58.33%)
	Above 9^{th} grade		25 (41.67%)
Primary caregiver's employment			
	Employed		38 (63.33%)
	Not employed		22 (36.67%)
Cerebral palsy status			
Cerebral palsy classification			
	Spastic type		35 (58.33%)
	Non-spastic type		25 (41.67%)
Anticonvulsant using			
	Presence		31 (51.67%)
Oral health behaviors			
Frequency of between meal carbohydrate foods and beverages intake (times/day)		2.28 ± (1.61)	
Food consistency	Solid and semi-solid		39 (65.00%)
	Liquid		21 (35.00%)
Brushing frequency	Once a day		30 (50.00%)
	At least twice a day		30 (50.00%)
Assisted brushing	Assisted		56 (93.33%)
	Not assisted		4 (6.67%)
Dental visit pattern	Regular		14 (23.33%)
	Non-regular		46 (76.67%)

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3. Oral health assessment of participants

3.1 Dental caries experience

The dental caries experience according to the decayed, missing, and filled surfaces (dmfs) in study sample were described in (Table 11). The prevalence of dental caries among the sample was 55 children (91.66%). The mean of non-cavitated caries, cavitated caries, extracted tooth and filled tooth were 4.08, 10.85, 1.71 and 2.06 surfaces per children, respectively. Overall mean dmfs in study group was 18.65 surfaces per children. Using Mann Whitney test, no significant difference of mean dmfs was found between genders (p=0.216).

Table 11 Dental caries experience (dmfs) in participants

Gender	d		m	f	dmfs ± SD
	Non-cavitated	Cavitated			
Male	2.77 ± 3.61	9.36 ± 10.77	0.18 ± 0.85	1.81 ± 4.66	14.13 ± 14.22
Female	4.84 ± 5.84	11.71 ± 15.84	2.60 ± 8.65	2.21 ± 3.83	21.26 ± 22.77
Total	4.08 ± 5.20	10.85 ± 14.14	1.71 ± 6.97	2.06 ± 4.12	18.65 ± 20.22
p-Value					0.216

Analysis using Mann-Whitney U Test; *p < 0.05, CI = 95%

3.2 Dental plaque index

Dental plaque assessment according to Greene and Vermillion's Simplified Oral Hygiene Index (OHI-S)[76] was recorded from 6 index teeth and divided the total score. The final dental plaque score in study sample range from 0.00-3.00, the mean final dental plaque score was 1.51 ± 0.69 (Table 12). The presence of dental plaque was recognized if it was visible with naked eye (OHI-S score ≥ 2) or considered as non-visible (OHI-S score < 2).

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Using Mann Whitney test, no significant difference of mean plaque score was found between genders (p = 0.215).

Table 12 Mean and standard deviation of final plaque score in participants

Gender	Number of children in each level of OHI-S		Final plaque score ± SD
	Non-visible (OHI-S score < 2)	Visible (OHI-S score ≥ 2)	
Male	18	4	1.36 ± 0.70
Female	25	13	1.59 ± 0.68
Total	43	17	1.51 ± 0.69
p-Value			0.215

Analysis using Mann-Whitney U Test; *p < 0.05, CI = 95%

4. Factor associated with dental caries experience in participants

4.1 Type of cerebral palsy

Classification of cerebral palsy was assessed according to predominant motor disorder as spastic type and non-spastic type. Participants in this study were diagnosed as 35 spastic CP (58.33%) and 25 non-spastic CP (41.67%).

The analysis in caries experience among two types of CP was conducted, spastic children were 4.51, 14.42, 2.80, 2.31 surfaces per children, respectively. The mean dmfs in spastic group was 24.22 surfaces per children. On the other hand, the mean of non-cavitated caries, cavitated caries, extracted tooth and filled tooth in non-spastic children were 3.48, 5.84, 0.22, 1.72 surfaces per children, respectively. The mean dmfs in non-spastic group was 24.22 surfaces per children. Using Mann Whitney test, the significant difference of mean dmfs was found between the two groups at 95% confident interval (p = 0.016). (Table 13)

Table 13 Dental caries experience according to type of cerebral palsy

Type of cerebral palsy	d		m	f	dmfs ± SD
	Non-cavitated	Cavitated			
Spastic type (n=35)	4.51 ± 5.86	14.42 ± 16.30	2.80 ± 8.98	2.31 ± 4.14	24.22 ± 23.56
Non-spastic type (n=25)	3.48 ± 4.13	5.84 ± 8.38	0.22 ± 1.00	1.72 ± 4.15	10.84 ± 10.48
p-Value	0.172	0.048*	0.079	0.304	0.016*

Analysis using Mann-Whitney U Test; *p < 0.05, CI = 95%

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The simple linear regression at 95% confident interval between type of cerebral palsy and dmfs was found significantly (p=0.012) with R-squared 0.103. This means the classification of cerebral palsy alone was able to explain the variation of dmfs in study group 10.30%. The standard error of the estimate was ± 20.66. (Table 14) This variable was selected to the multiple regression model.

Table 14 Simple regression analysis for estimate dmfs from type of cerebral palsy

Constant/ Variables	Unstandardized Coefficients		β	t	*p*-Value
	B	SE_b			
Constant	12.160	4.133		2.942	0.005
Spastic type CP	13.954	5.411	0.321	2.579	0.012*

Analysis using simple linear regression; *p < 0.05, CI = 95%

4.2 Frequency of between meal carbohydrate foods and beverages intake

The primary caregivers of children with CP were instructed for three-day food record including 2 weekdays and 1 weekend. The results showed that mean of frequency of between meal carbohydrate intake among the study group was 2.28 ± 1.61 times per day. The frequencies were ranged from 0.00 to 6.66 times per day.

There were 29 children (48.33%) who had in between meal carbohydrate food and beverages intake 2 times per day or less. There were 31 children (51.67%) had more than 2 times between meal carbohydrate intake in a day. the mean of non-cavitated caries, cavitated caries, extracted tooth and filled tooth according to daily between meal carbohydrate intake were presented in Table 15. Using Mann Whitney test, the significant difference of mean cavitated surfaces, extracted, filled surfaces and dmfs was found between the two groups at 95% confident interval (p=0.002).

Table 15 Dental caries experience according to frequency of between meal carbohydrate foods and beverages intake

Frequency	d		m	f	dmfs ± SD
	Non-cavitated	Cavitated			
≤2 times/day (n=29)	2.61 ± 3.73	5.96 ± 8.49	0.96 ± 3.27	0.83 ± 2.92	10.80 ± 12.37
>2 times/day (n=31)	5.86 ± 6.22	16.86 ± 17.96	4.31 ± 10.45	3.58 ± 6.92	30.44 ± 24.80
p-Value	0.085	0.045*	0.034*	0.025*	0.002*

Analysis using Mann-Whitney U Test; *p < 0.05, CI = 95%

The simple linear regression at 95% confident interval between >2 times daily between meal carbohydrate foods and beverages intake frequency and dmfs was found significantly (p = 0.001) with R-squared 0.173 (Table 16). This means more than 2 times of carbohydrate foods and beverages intake between meals was able to explain the variation of dmfs in study group of 17.3%. The standard error of the estimate was ± 19.83. This variable was selected to the multiple regression model.

Table 16 Simple regression for estimate dmfs from between meal carbohydrate intake

Constant/ Variables	Unstandardized Coefficients		β	t	*p*-Value
	B	SE_b			
Constant	11.069	3.684		3.005	0.004
>2 times/day	17.867	5.125	0.416	3.486	0.001*

Analysis using simple linear regression; *p < 0.05, CI = 95%

4.3 Food consistency

To assess the food consistency (solid/semi-solid food and liquid food) for the study participants, each caregiver was asked to identify which of the consistencies was provided as
the main diet. The results showed that 39 (65%) of participants received solid or semi-solid food and 21 (35%) of participants received liquid food.

The mean of non-cavitated caries, cavitated caries, extracted tooth and filled tooth according to daily between meal carbohydrate intake were presented in Table 17. No significant difference of all dmfs index was found between both group of food consistencies.

Table 17 Dental caries experience according to food consistency

Food consistency	d		m	f	dmfs ± SD
	Non-cavitated	Cavitated			
Solid and semi-solid (n=39)	4.17 ± 5.43	10.23 ± 13.15	2.51 ± 8.00	1.97 ± 4.08	19.07 ± 19.81
Liquid (n=21)	4.19 ± 5.20	13.09 ± 17.74	2.71 ± 7.46	2.52 ± 7.32	22.57 ± 25.01
p-Value	0.962	0.673	0.663	0.553	0.822

Analysis using Mann-Whitney U Test; *p < 0.05, CI = 95%

4.4 Frequency of toothbrushing

The toothbrushing habits were interviewed by structured questionnaire. 30 (50%) of participants had been brushed less than 2 times per day. The mean of non-cavitated caries, cavitated caries, extracted tooth and filled tooth according to frequency of toothbrushing were presented in Table 18. The significant difference of non-cavitated lesion, cavitated lesion and dmfs were found between both frequencies.

Table 18 Dental caries experience according to frequency of toothbrushing

Frequency of toothbrushing	d		m	f	dmfs ± SD
	Non-cavitated	Cavitated			
<2 times per day (n=30)	6.36 ± 6.47	13.60 ± 13.38	4.00 ± 9.93	1.70 ± 3.50	25.76 ± 22.59
≥2 times per day (n=30)	2.00 ± 2.36	8.86 ± 16.03	1.16 ± 4.42	2.63 ± 6.80	14.83 ± 19.48
p-Value	0.004*	0.048*	0.092	0.935	0.009*

Analysis using Mann-Whitney U Test; *p < 0.05, CI = 95%

The simple linear regression at 95% confident interval between brushing frequency and dmfs was found significantly (p=0.049) with R-squared 0.065. This means the frequency of toothbrushing was able to explain the variation of dmfs in study group 6.5%. The standard error of the estimate was ± 21.09. (Table 19)

Table 19 Simple regression analysis for estimate dmfs from brushing frequency

Constant/ Variables	Unstandardized Coefficients		β	t	*p*-value
	B	SE_b			
Constant	14.833	3.852		3.851	0.000
toothbrushing <2 times/day	10.933	5.447	0.255	2.007	0.049*

Analysis using simple linear regression; *p < 0.05, CI = 95%

4.5 Assisted brushing

All of 60 children enrolled in the study, the tooth cleaning was carried out in 56 children (93.3%). The mean of non-cavitated caries, cavitated caries, extracted tooth and filled tooth according to assisted toothbrushing were presented in Table 20. The significant difference of cavitated lesions, extracted tooth and dmfs were found between both groups.

Table 20 Dental caries experience according to assisted brushing

Assisted brushing	d		m	f	dmfs ± SD
	Non-cavitated	Cavitated			
Not assisted (n=4)	10.00 ± 10.09	20.00 ± 4.96	4.25 ± 3.30	3.00 ± 4.76	37.25 ± 16.45
Assisted (n=56)	3.76 ± 4.69	10.60 ± 15.12	2.46 ± 7.98	2.10 ± 5.45	19.08 ± 16.45
p-Value	0.260	0.033*	0.008*	0.400	0.042*

Analysis using Mann-Whitney U Test; *p < 0.05, CI = 95%

However, according to the simple linear regression at 95% confident interval, type of assisted brushing and dmfs was found no significantly (p=0.145) (Table 21). Thus, the variable was not selected in to the final model.

Table 21 Simple regression analysis for estimate dmfs from group of assisted brushing

Constant/ Variables	Unstandardized Coefficients		β	t	*p*-value
	B	SE_b			
Constant	19.089	2.850		6.699	0.000
Not assisted brushing	18.161	11.036	0.211	1.646	0.105

Analysis using simple linear regression; *p < 0.05, CI = 95%

4.6 Dental plaque index.

The mean final dental plaque score in the study group was 1.51 ± 0.69, ranged 0.00-3.00. The presence of dental plaque was categorized in visible plaque accumulation
(OHI-S score ≥ 2) or non-visible accumulation (OHI-S score < 2). Using Mann Whitney test, no significant difference of dmfs was found between groups of plaque accumulation (p=0.287).

Table 22 Simple regression analysis for estimate dmfs from dental plaque accumulation

Dental plaque accumulation	d		m	f	dmfs ± SD
	Non-cavitated	Cavitated			
Non-visible plaque (n=43)	3.97 ± 5.20	9.95 ± 14.79	2.65 ± 8.23	2.34 ± 6.09	19.04 ± 21.05
Visible plaque (n=17)	4.70 ± 5.68	14.47 ± 14.87	2.41 ± 6.62	1.70 ± 3.01	23.47 ± 23.37
p-Value	0.797	0.130	0.981	0.378	0.287

Analysis using Mann-Whitney U Test; *p < 0.05, CI = 95%

5. The Analysis of factors associated with dental caries experience by multiple linear regression

According to the dependent variables (dmfs) which were continuous data, the linear regression analysis was used to examine the association between multiple independent variables and the outcome. The variables which significantly associated with dmfs score in the unadjusted analyses were considered for inclusion in the final model. The selected variables were brushing frequency, bushing assistance, frequency of between meal carbohydrate food and beverages intake and type of cerebral palsy. A stepwise procedure for model building was used to obtain the most parsimonious model.

The stepwise multiple linear regression model (Table 23) showed that 2 variables which are more than 2 times of between meal carbohydrate food and beverages intake and type of cerebral palsy significantly associated with dmfs score. The coefficient of multiple determination (R-squared) of the model was 0.27, the adjusted R-squared was 0.25 ($p < 0.000$).

Table 23 Stepwise multiple linear regression model for prediction of dmfs score

Constant/ Variables	Unstandardized Coefficients		β	t	P-value
	B	SE_b			
Constant	5.854	4.359		1.343	0.185
Frequency of between meal carbohydrate intake	15.764	5.081	0.367	3.103	0.003*
Spastic type CP	10.802	5.150	0.248	2.097	0.040*

R = 0.526, R-squared = 0.276, Adjusted R-squared = 0.251

Standard error of the estimated (SE) = ±19.72

F = 10.886, P-value < 0.000

CHAPTER V
DISCUSSION

This cross-sectional study aimed to investigate the factors affecting of dental caries experience (dmfs) in Thai preschool children with CP attended physical therapy programs in non-governmental rehabilitation centers in Bangkok. The factors were (1) type of cerebral palsy, (2) frequency of between meal carbohydrate food and beverages taking, (3) food consistency, (4) frequency of toothbrushing, (5) assisted brushing, and (6) dental plaque index (OHI-S). The sampling frame was all of 7 rehabilitation centers of the Foundation of Children with Disability located around Bangkok. All of the centers provided similar rehabilitation programs to children with neuromotor disabilities, which were divided into 4 therapeutic stations. To reduce the interference with the regular program, the oral examination and interview were performed as the 5th additional station. From the sample size calculation with the model multiple regression, the total sample size was 52. According to inclusion criteria, sixty participants (90.90%) were enrolled in the study. This study did not include the children with feeding tube, that had different food consumption behaviors. Study of Hidas and Cohen found that tube-fed children had significantly lower dental caries index compared with healthy children and children with disabilities orally fed.[82] This could be explained that the dental plaque of children with tube-fed was not exposed to fermentable carbohydrates, which demonstrated in low level of cariogenic bacteria.[82, 83]

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In this study, the term ‘dental caries experience’ was used to demonstrate the past and present dental caries status, determined by the surfaces of currently carious lesions, restored teeth, and teeth missing due to caries (dmfs). The carious lesions were defined as the presence of both non-cavitated and cavitated lesions. According to the policy of the American Academy of Pediatric Dentistry, the non-cavitated caries is a part of a definition of early childhood caries in a child under age of six.[84] The detection at an initial stage of caries lesion is important for managing the disease and it should be considered as a relevant disease marker that represent dental caries status in individuals.[85]

In this study, mean dmfs of participants was 20.30 ± 21.63 surfaces per person, with the prevalence of dental caries experience 91.66%. The high number of dental caries rate was similar with study in Brazil[10] and Saudi Arabia[86] which reported 83% and 98% prevalence of dental caries experience in preschool children with CP, respectively.

On the other hand, the prevalence of dental caries experience in preschool children with CP was and 42.5% in Hongkong.[31] This may cause by the adequacy of oral health service in Hongkong resulted in low prevalence of oral disease. Moreover, the dental caries experience in participants tended to increase with age. In the study of subjects with CP, aged 4 to 17 years, Rodrigues Santos also found that the increasing of dental caries rates was related with age.[8] The progression of carious lesion from primary dentition to permanent dentition could lead to nutrition problems and overall health,[87] and resulted in significant burden for caregivers of CP children.[8] Therefore, an early intervention should be initiated to these young patients.

Among the mean dental caries experience of 20.30 ± 21.63 surfaces per person, the mean of non-cavitated lesion was 4.18 ± 5.30 surfaces per person (20.6%). The non-cavitated carious lesions should be immediately treated by remineralization with the intervention with topical fluoride. Lee and Baek[88] found that 42% of initial carious lesions can be remineralized with 5% NaF varnish. Meta-analysis also showed that fluoride varnish can reduce 37% in decayed, missing and filled tooth surfaces in primary dentition.[89] Furthermore, fluoride varnish using has been regarded as a safe and effective caries control in special patients.[90, 91] Therefore, the initial caries detection and fluoride intervention should be reinforced in the dental health programs in preschool children with CP, to promote caries prevention and reduce necessity of referrals for more complicated dental care.

The low level of dental treatment in participants reflected the problems of access to dental care among preschool children with CP. In this study, only 23.33% of participants received regular dental care, which were mostly in governmental hospitals. Several previous reports confirmed that the population with disability have difficulties in access to dental care.[44-46] One study in Brazil reported that a lack of trained dental professionals was the most difficulty encountered in oral health services accessibility among children with CP.[92] Furthermore, study in United states found that children with special health care needs had some barriers to dental care which contained severity of children's complications and cost of care.[48] In Thailand, despite the high cost of dental treatment, Thai children with disabilities including CP, have privilege in free of charges for dental care utilization in governmental health services. The National Health Security Office response for the health care expense of registered CP children. Therefore, the primary caregivers should be informed about right awareness to reduce the financial barriers to dental care.

According to high prevalence of dental caries experience (91.66%), the multiple linear regression should be used to analyze the associated factors with dental caries

experience in the study group. It was found that the predictable variables for dental caries experience (dmfs) comprised the frequency of between meals carbohydrate food and beverages intake and type of CP. The regression analysis indicated that spastic type of CP will exhibit approximately 10.80 dmfs greater than the non-spastic type. The spastic CP children have limited movements, have more frequent of the hyperactive biting reflex, and exhibited oral rigidity or spasticity. This resulted in prolonging of food retention in oral cavity,[93] and increased difficulties to perform an adequate oral hygiene.[19] This observation was consistent with the hypothesis that children with severe neurological damage would be more likely to have impaired dental caries status.

The dietary information of participants were collected from the three-days food records by primary caregiver, which recommended in the study of Walker in acceptable validity and accurately measured dietary intake in preschool-aged children with CP.[94] The researcher specify the date of recording and assigned primary caregivers to immediately return the records via mobile application at the end of the day. This is the first study showing the influence of dietary information sourced from food records on dental caries experience in preschool children with CP. For the purpose of the study, the frequency of between meal carbohydrate food and beverages intake was categorized in 2 groups, more than two times daily and 2 times or less.

In this study, threshold effect was found for the frequency of between meal carbohydrate consumption on dental caries experience of two times a day. A consumption of carbohydrates enables the cariogenic bacteria that are in dental biofilm generating acid byproducts from sugars. This acid leads to demineralization of tooth enamel structure depending on the total pH decrease, as well as the length of time that the pH is below 5.2 to 5.5, which is the range of critical level.[95] The depressed pH value remains as long as sugar is available and acid is produced. Overtime, the pH value returned to regular level with the presence of saliva and the buffering capacity of dental plaque, resulted in the reminerlaization.[96] Frequent and exposure time to the lower pH environment without sufficient time for remineralization can result in prolonged pH fall and more loss of mineral[97] towards an overall caries lesion formation.[96, 98] In accordance with the literature, in a *in situ* study, Duggal et al. compared the extent of demineralization of enamel slabs with various frequencies of carbohydrate consumptions. The authors found that the net demineralization was evident only with subjects who had more than 5 times/day carbohydrates intake. They also suggested that consumption of carbohydrate up to 5 times a day did not result in enamel demineralization.[99] According to the guidelines, the American Academy of

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Pediatric Dentistry (AAPD) specified that more than twice daily between meal exposures to sugared food was a risk indicator for dental caries in healthy children.[100]

In preschool children with CP, the limitation to 5 times carbohydrate intake or twice per day of between meal carbohydrate snacks and beverages may contributed by the prolonged mealtimes which commonly seen in these children.[101] This probably lengthen the time of carbohydrate adherence, lead to extended periods of demineralization and to shortened periods of remineralization. In a study of 2-17 years old CP children in Brazil, De camargo and Antunes showed that more than two daily events of sugar containing snacks intake was associated with the prevalence of untreated caries in deciduous or permanent teeth in children with CP[16]. Another study in Bangladesh, Akhter et al. also found that snacking between meals more than one time per day had associated with dental caries experience in CP children aged 2–17 years old.[13] Similar to this study, if carbohydrate intake is limited to a maximum of 1-2 times a day, dental caries levels will be reduced. Therefore, it is necessary for emphasis on dental caries prevention through limitation of between meal carbohydrate intake in this population.

From this study, dental caries experience in preschool children with CP did not associate with dental plaque index, the food consistency, frequency of toothbrushing and toothbrushing assistant.

The mean of dental plaque index according to Greene and Vermillion's Simplified Oral Hygiene Index (OHI-S)[76] among participants was 1.51 ± 0.69. The visible plaque accumulation (OHI-S ≥ 2) was found in 17 children (28.33%), and 43 children (71.67%) were noticed with non-visible plaque accumulation (OHI-S < 2). There was no relationship between level of dental plaque accumulation and dental caries experience. This is in agreement with Mathias[102] who mentioned that the relationship between dental plaque index and dental caries risk was very weak due to various types of dental plaque, with particular metabolic activities and microbiological constitutions. It was difficult in clinically differentiate between cariogenic and non-cariogenic plaque.

Considering the toothbrushing habits among the preschool children with CP. All participants practiced daily tooth brushing with the use of toothpastes. Fifty-six of the them (93.33%) receive parental assistance in tooth brushing. The high proportion of assistance in tooth brushing was similar with study of Rennan et al.[46], which reported that 90.3% of two to six year-old children with CP in Hongkong received assisted toothbrushing. However, this number decreased when individuals with CP get older. Study of Chu and Lo,[67] reported only 45% of 13-17 year-old teenagers with CP in Hongkong received assistance in tooth brushing. According to an increase in age, the

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burden on the caregivers may increase as the person with CP may develop the physical deformities problems and decreased cooperation. This could lessen the intention of caregivers to perform adequate oral hygiene. In this study, thirty of the children (50%) received toothbrushing twice or more times daily. However, the frequency of toothbrushing was not associated with dental caries experience in participants. Despite daily tooth brushing, the dental caries experience in study group was high. The study of Chu and Lo also found no relation between caries experience in teenagers with CP and frequency of brushing or parental assistance in tooth brushing.[67] This could be inferred that the cleaning frequency and assisted brushing did not represent the quality of tooth cleaning.[103] Moreover, it was considered that most of the population cannot perform optimal control of biofilm with toothbrushing alone, and fluoride in the toothpaste was recognized of major role in caries prevention.[104]

The primary caregivers of CP children may challenge by the difficulties of completed plaque removal. Furthermore, performing regular toothbrushing in children with CP was troublesome due to their uncooperative and resisted behaviors. This probably are the barriers for caregivers to achieve the standard oral hygiene habit.[105] The powered toothbrush was reported to be more effective in maintaining oral hygiene than manual toothbrush.[106] However, the superior effect of powered toothbrush using in CP children was inconclusive.[36] Therefore, the competent manual toothbrushing can be recommended to be used with CP children. Moreover, the various combined oral hygiene strategies in children with CP had been reported to adjunct the regular toothbrushing. One study recommended that combined mechanical plaque control with chlorhexidine gluconate spray result in gingivitis reduction and better oral health in individuals with CP.[107] Removing food debris and particles from cheek bulge with clean towel had also been recommended.[108]

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In this study, the food consistency was classified as solid/semisolid (65%) and liquid (35%). The results also showed no association between food consistency and dental caries experience. Similar with a study of Akhter[13], which found no relation between dietary consistency and dental caries experience in primary and permanent dentition in children with CP. This may be explained that the physical consistency of food alters the frequency of exposure and duration of adherence to tooth surface. For instance, a liquid diet is prone to be digested more quickly and is likely to be consumed more frequently, while a solid food may be prolonged retentive in a mouth. Therefore, it is likely that the frequency and the length of time that the teeth are exposed to carbohydrate foods is a critical factor in the promotion of caries rather than the consistency of the food.

According to the findings of this study, frequency of between meals carbohydrate food and beverages intake and type of CP were found to associated with dental caries experience. The model had R square 0.25, which mean that the constructs of the variables accounted for 25% of the dental caries experience among children with CP in this study. This indicated that factors other than one perceived influence on frequency of dietary and type of CP should be investigated in the future. However, the impact of certain limited number of variables on a behavior related outcome confine the majority of variance explained.

91.66% of participants had dental caries experience, this emphasized the necessity to conduct an oral health program based on the prevention of dental caries for these population. The prevention strategy should be effectively provided to the CP children from birth onwards. As infants with CP, there is a need for integrating dental education and oral hygiene practice with multidisciplinary health care with the instruction media which suitable contents for young children. Considering the access to dental care, the policy should set up rapid special patient's referral system, therefore dental health professionals can early refer CP children to dental service. The regular dental care should be continued to conduct routine dental examination and provide proper oral hygiene instruction.

This study indicated that eating behavior especially the frequency of between meal carbohydrate intake was critically important to dental caries experience, and should be emphasized in oral health promotion in preschool children with CP. The interventions should be designed to various levels, from individuals to organization. At individuals level, the knowledge regarding to association between diets and oral health should be provided to primary caregivers. This also included encouraging primary caregivers that controlling carbohydrate consumption was important to prevent caries in children. At interpersonal level, the reinforcement on changing eating habits from the rehabilitation centers members and staffs are important to support the compliances of caregivers. At the organizational level, the rehabilitation centers should align with efforts to reduce the consumption of cariogenic food. Oral health policy included limiting the number of between meal carbohydrate food, snacks and sugared beverages should be announced. Moreover, the centers should consider in restricting sugary snacks or sweetened beverages from food donation.

Large number of children with CP in this study needed comprehensive dental care under general anesthesia which available in tertiary care hospitals and university hospitals. The dental department of the hospitals in charge should collaborate with rehabilitation centers, as the primary health care units, to provide dental care service

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to children with CP. National Health Security Office should define the extent of responsible area of the hospitals according to children's residency, to reduce barriers to dental care. Furthermore, dental schools should involve clinical exposures and experiences in the dental management of CP children to the undergraduate program, to diminish the unwillingness and discomfort of dentist from lack of experience to see the disabled population. This encourage oral health implementation to be continual when the children get older.

The preschool children with CP had several factors of experiencing dental caries, which could be related to difficulties in performing adequate oral hygiene and poor dietary habits. Efforts should be made to improve oral health and emphasize an appropriate frequency of diet. This study concluded that the frequency of carbohydrate intake plays an important role in association with dental experience in preschool children with CP. The data suggested that the limit to 2 times per day consumption of between meal carbohydrate foods and beverages intake could be contributed in promoting the dental health of this challenged children.

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ภาคผนวก

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แบบสอบถามสำหรับผู้ดูแลหลัก

ส่วนที่ 1 ข้อมูลทั่วไปเกี่ยวกับเด็ก

	สำหรับผู้วิจัย
1. เพศของเด็ก ☐ ชาย ☐ หญิง 2. วัน เดือน ปี เกิด _____ 3. น้ำหนักแรกเกิดของเด็ก _____ กรัม น้ำหนักขณะนี้ _____ กิโลกรัม	☐ M ☐ F Age _____ M
4. จำนวนสมาชิกทั้งหมดในครอบครัว _____ คน 5. จำนวนบุตรในครอบครัวทั้งหมดที่มี _____ คน 6. บุตรที่พามาตรวจ เป็นบุตรคนที่ _____	
7. เด็กได้รับยากันชักหรือไม่ ☐ ไม่ได้รับ ☐ ได้รับ ระบุชื่อ ยา _____	Anticonvulsants Medication ☐ Yes ☐ No
8. เด็กไปโรงเรียนหรือไม่ ☐ ไป เริ่มไปตั้งแต่อายุ _____ ปี ☐ ไม่ได้ไป 9. เด็กมีภาวะสมองพิการลักษณะใด ☐ Spastic CP ☐ Quadriplegia ☐ Diplegia ☐ Hemiplegia ☐ Non-spastic CP ☐ Dyskinetic ☐ Ataxic	☐ Spastic ☐ Non spastic ☐ Quadriplegia ☐ Non-quadriplegia

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ส่วนที่ 2 พฤติกรรมการรับบริการทันตสุขภาพของเด็ก

	สำหรับผู้วิจัย
10. เด็กเคยไปทำฟันหรือไม่ ☐ ไม่เคย ☐ เคย เมื่อเด็กอายุ _____ เดือน ☐ จำไม่ได้ **(<u>หากไม่เคย หรือ จำไม่ได้ ข้ามไปตอบข้อ 15</u> ✡✡✡)**	
11. ท่านพาเด็กไปพบทันตแพทย์บ่อยแค่ไหน ☐ ไปน้อยกว่า 1 ครั้งต่อปี ☐ ไป 1 ครั้งต่อปี ☐ ไป 2 ครั้งต่อปี หรือมากกว่า	☐ Regular ☐ Non-regular
12. เด็กได้รับการรักษาทางทันตกรรมที่ใด ☐ คลินิก หรือ โรงพยาบาลเอกชน ☐ ศูนย์บริการสุขภาพ หรือ โรงพยาบาลรัฐบาล ☐ คณะทันตแพทย์ศาสตร์ในมหาวิทยาลัย	☐ Private ☐ Government
13. เด็กเคยได้รับการรักษาทางทันตกรรมด้วยวิธีใด ☐ จับทำ (มีการห่อตัว หรือใช้คนช่วยจับบนเตียงทำฟันปกติ) ☐ กินยาให้สงบ ☐ ดมยาสลบ	
✡✡✡ <u>ถ้าไม่เคยพาไปพบทันตแพทย์ ตอบข้อ 15</u> 14. สาเหตุที่เด็กไม่ไปทำฟันคือ (ตอบได้มากกว่า 1 ข้อ) ☐ เด็กไม่ได้ปวดฟัน ☐ มีความลำบากในการเดินทางและเคลื่อนย้ายเด็ก ☐ เด็กไม่มีฟันผุ ☐ ไม่มีทันตแพทย์ที่รับทำ หรือ ไม่รู้ว่าจะพาไปทำที่ไหน ☐ เด็กไม่สามารถให้ความร่วมมือได้ ☐ คิดว่าเป็นเพียงฟันน้ำนมจึงไม่ต้องรักษา ☐ ค่าใช้จ่ายในการทำฟันสูง ☐ อื่นๆ ระบุ _____	

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ส่วนที่ 3 พฤติกรรมการดูแลสุขอนามัยช่องปากของเด็ก

15. เด็กได้รับการแปรงฟันหรือเช็ดฟันตั้งแต่อายุเท่าไร _____ ปี ☐ จำไม่ได้/ไม่ทราบ 16. ใน 1 ปีที่ผ่านมา เด็กได้รับการทำความสะอาดฟันอย่างไร ☐ ไม่ได้ทำความสะอาดช่องปากเด็ก **(ข้ามไปตอบข้อ 22 ✡✡✡)** ☐ ทำความสะอาดโดย ( ) เช็ดฟัน ( ) แปรงฟัน 17. ใช้ยาสีฟันหรือไม่ ☐ ไม่ได้ใช้ยาสีฟัน ☐ ใช้ยาสีฟัน โปรดระบุยี่ห้อ _____	**สำหรับผู้วิจัย** ☐ Receive oral care ☐ Not Receive oral care ☐ Non-F toothpaste ☐ F toothpaste
18. ใน 1 ปีที่ผ่านมา ใครเป็นผู้ทำความสะอาดช่องปากให้เด็ก ☐ เด็ก ☐ ผู้ปกครองแปรงให้ ☐ เด็กและผู้ปกครอง 19. ใน 1 ปีที่ผ่านมา เด็กแปรงฟันและ/หรือเช็ดฟัน สม่ำเสมอหรือไม่ ☐ ทำบางวัน ☐ ทำทุกวัน วันละ 1 ครั้ง ☐ ทำทุกวัน วันละ 2 ครั้ง หรือมากกว่า	☐ Non-assisted brushing ☐ Assisted brushing ☐ < 2 ☐ ≥ 2
20. แปรงสีฟันของเด็กมีลักษณะใด ☐ ไม่ได้ใช้แปรงสีฟัน ☐ แปรงสีฟันธรรมดา ☐ แปรงสีฟันไฟฟ้า	
✡✡✡ **ถ้าไม่ได้แปรงทุกวัน ตอบข้อ 22** 21. ทำไมเด็กจึงไม่ได้แปรงฟันทุกวัน (ตอบได้มากกว่า 1 ข้อ) ☐ เด็กไม่ให้ความร่วมมือ ☐ เด็กแปรงเองไม่เป็น ☐ ผู้ปกครองไม่มีเวลาแปรงให้ ☐ อื่นๆ ระบุ _____	

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ส่วนที่ 4 พฤติกรรมการรับประทานอาหารของเด็ก

	สำหรับผู้วิจัย
22. เด็กกินอาหาร**หลัก** วันละ _____ มื้อ เด็กกินอาหาร**ว่าง** วันละ _____ มื้อ	
23. เด็กสามารถรับประทานอาหารเหมือนกับผู้ปกครองได้หรือไม่ ☐ ได้ ☐ ไม่ได้ โดยเด็กมีข้อจำกัด _____	☐ Liquid ☐ Semisolid, Solid

ส่วนที่ 5 ข้อมูลทั่วไปเกี่ยวกับผู้ดูแลหลัก

	สำหรับผู้วิจัย
24. เพศของผู้ดูแลหลัก ☐ ชาย ☐ หญิง 25. วัน เดือน ปี เกิด _____	Age _____ Y
26. ท่านมีความสัมพันธ์กับเด็กเป็น ☐ พ่อ ☐ พี่เลี้ยง ☐ แม่ ☐ ญาติ ☐ ปู่ย่า / ตายาย ☐ อื่นๆ โปรดระบุ _____ 27. ท่านเริ่มต้นดูแลเด็กมา นาน _____ปี _____เดือน 28. ท่านมีหน้าที่ดูแลเด็ก ในช่วงเวลา ☐ กลางวัน ☐ กลางคืน สัปดาห์ละ _____วัน วันละ _____ชั่วโมง	☐ Family member ☐Non Family member
29. การศึกษาสูงสุดของท่าน ☐ ประถมศึกษา หรือต่ำกว่า ☐ มัธยมศึกษาปีที่ 6 หรือเทียบเท่า ☐ มัธยมศึกษาปีที่ 3 ☐ อนุปริญญา, ปวช, ปวส ☐ ปริญญาตรี ☐ ปริญญาโท หรือ สูงกว่า ☐ อื่นๆ ระบุ _____ 30. อาชีพหลักของท่าน ☐ แม่บ้าน / ไม่ได้ทำงาน ☐ รับราชการ / รัฐวิสาหกิจ ☐ ค้าขาย ☐ ลูกจ้าง / พนักงานบริษัท ☐ อื่นๆ ระบุ _____	☐ ≤ grade 9 ☐ > grade 9 ☐ Unemployed ☐ Employed

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☐ วันธรรมดา ☐ วันหยุด

ชื่อ-นามสกุล

บันทึกการรับประทานอาหารครั้งที่.....วันที่.....

เวลาที่เริ่มกิน	**เวลาที่กินเสร็จ**	**เมนู**		สำหรับผู้วิจัย	
		รายการอาหาร	**ปริมาณ**	ชนิดอาหาร	ความถี่

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แบบบันทึกผลการตรวจสุขภาพช่องปากเด็ก

รหัสเด็ก .....
วันที่ตรวจ (ว/ด/ป) .....

เพศ ( ) ชาย ( ) หญิง
กลุ่ม ( ) Spastic ☐ Quadriplegia ☐ Non Quadriplegia
( ) Non-spastic
ระดับ GMFCS ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

ซี่	O	M	D	B	L	*	หมายเหตุ	ซี่	O	M	D	B	L	*	หมายเหตุ
55								85							
54								84							
53								83							
52								82							
51								81							

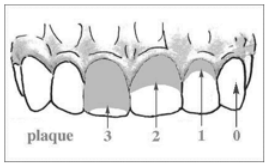
ซี่	O	M	D	B	L	*	หมายเหตุ	ซี่	O	M	D	B	L	*	หมายเหตุ
65								75							
64								74							
63								73							
62								72							
61								71							

รหัสตรวจฟัน
0 ฟันดี
1 ฟันผุไม่เป็นรู
2 ฟันผุเป็นรู
3 ฟันอุดแล้วผุต่อ
4 ฟันผุอุดแล้วไม่ผุต่อ
5 ฟันที่ถูกถอนไปจากการผุ

*ลงข้อมูลที่เป็น 5

Gingival index
คะแนน 0 = ไม่มีเลือดออกและสภาพเหงือกปกติ
คะแนน 1 = สภาพเหงือกมีการอักเสบ แต่ไม่มีเลือดออก
คะแนน 2 = สภาพเหงือกมีการอักเสบและมีเลือดออก
คะแนน 3 = สภาพเหงือกอักเสบมากและง่ายต่อการมีเลือดออก

Plaque index (Greene and Vermillion's OHI-S)



ซี่ฟัน	Gingival index					Plaque index	
	M	D	B	L	คะแนนซี่ฟัน		
55						B	
61						B	
64						B	
75						Li	
71						B	
84						Li	
Total							

ข้อมูลและรายละเอียดเกี่ยวกับการวิจัย (สำหรับผู้ดูแลหลัก)

ภาควิชาทันตกรรมสำหรับเด็ก
คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ถนนอังรีดูนังต์ เขตปทุมวัน กรุงเทพมหานคร 10330

วันที่.....

เรียน ท่านผู้ดูแลหลัก

เด็กสมองพิการมักมีปัญหาสุขภาพช่องปาก ด้วยข้อจำกัดทางการเคลื่อนไหวและข้อบกพร่องในการควบคุมกล้ามเนื้อ เด็กส่วนใหญ่จึงแปรงฟันได้ไม่ดี ทำให้เกิดการสะสมของเศษอาหารและคราบจุลินทรีย์ ซึ่งนำไปสู่การเกิดโรคฟันผุและโรคปริทันต์ ดังนั้น เด็กสมองพิการจึงควรได้รับการป้องกันฟันผุอย่างเหมาะสมและรับการตรวจฟันอย่างสม่ำเสมอ

ในการวิจัยนี้ เป็นการศึกษาเพื่อค้นหาปัจจัยที่เกี่ยวข้องกับโรคฟันผุ เพื่อนำข้อมูลมาใช้ในการวางแผนป้องกันฟันผุให้เหมาะสมสำหรับเด็กสมองพิการชาวไทย ผู้วิจัยจึงขอเชิญชวนผู้ดูแลหลักและเด็กเข้าร่วมงานวิจัยเรื่อง “ปัจจัยที่เกี่ยวข้องกับฟันผุในเด็กสมองพิการในช่วงก่อนวัยเรียน ที่เข้ารับบริการในศูนย์ฝึกกายภาพบำบัดขององค์กรพัฒนาเอกชน” โดยทำการวิจัยที่ศูนย์การเรียนรู้ฟื้นฟูเด็กพิการ จำนวน 8 ศูนย์ ของมูลนิธิเพื่อเด็กพิการ กรุงเทพมหานคร ซึ่งการวิจัยจะประกอบด้วยขั้นตอนดังนี้

1. ทันตแพทย์ตรวจสุขภาพฟันและเหงือกของเด็กสมองพิการ อายุ 3-6 ปี
2. ทันตแพทย์สัมภาษณ์ผู้ดูแลหลัก เกี่ยวกับข้อมูลทั่วไปของเด็ก พฤติกรรมการดูแลสุขภาพช่องปาก พฤติกรรมการรับประทานอาหาร และพฤติกรรมการใช้บริการทางทันตกรรม ของเด็กสมองพิการ
3. ทันตแพทย์สัมภาษณ์เกี่ยวกับข้อมูลของผู้ดูแลหลัก

ภายหลังการวิเคราะห์และรวบรวมข้อมูล ทันตแพทย์จะแจ้งผลการตรวจสุขภาพช่องปากเด็ก คำแนะนำเกี่ยวกับทันตกรรมป้องกัน รวมทั้งคำแนะนำให้การรักษาทางทันตกรรมแก่ผู้ดูแลหลัก

การเข้าร่วมโครงการวิจัยครั้งนี้ผู้เข้าร่วมวิจัยไม่ต้องเสียค่าใช้จ่ายและเป็นโดยสมัครใจ ผู้ดูแลหลักและเด็กอาจปฏิเสธที่จะเข้าร่วม หรือมีสิทธิ์บอกเลิกการเข้าร่วมวิจัยเมื่อไหร่ก็ได้ ผู้วิจัยรับรองว่าจะเก็บข้อมูลส่วนบุคคลเป็นความลับ และจะเปิดเผยเฉพาะในรูปแบบที่เป็นสรุปผลวิจัย การเปิดเผยข้อมูลต่อหน่วยงานที่เกี่ยวข้องกระทำได้เฉพาะกรณีจำเป็นด้วยเหตุผลทางวิชาการและได้รับความยินยอมจากผู้ดูแลหลัก

หากท่านมีปัญหา หรือข้อสงสัยประการใด กรุณาติดต่อ ทพญ.กุลนันท์ พันธ์ศรีมังกร นิสิตปริญญาโท ภาควิชาทันตกรรมสำหรับเด็ก คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย โทร. 083-970-8988

ขอแสดงความนับถือ

ลงนาม.....ทันตแพทย์ผู้วิจัย
(ทพญ. กุลนันท์ พันธ์ศรีมังกร)
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ข้อมูลและรายละเอียดเกี่ยวกับการวิจัย (สำหรับเด็ก)

ภาควิชาทันตกรรมสำหรับเด็ก
คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ถนนอังรีดูนังต์ เขตปทุมวัน กรุงเทพมหานคร 10330

วันที่.....

เรียน น้อง ๆ ที่สนใจเข้าร่วมงานวิจัย

เด็กสมองพิการมักมีสุขภาพช่องปากไม่ดี เพราะน้องแปรงฟันเองไม่สะอาด ทำให้ฟันผุและเหงือกอักเสบ ในงานวิจัยเรื่อง “ปัจจัยที่เกี่ยวข้องกับฟันผุในเด็กสมองพิการในช่วงก่อนวัยเรียน ที่เข้ารับบริการในศูนย์ฝึกกายภาพบำบัดขององค์กรพัฒนาเอกชน” ที่ศูนย์การเรียนรู้ฟื้นฟูเด็กพิการ จำนวน 8 ศูนย์ ของมูลนิธิเพื่อเด็กพิการ กรุงเทพมหานคร พี่จะมาตรวจฟันน้องและสัมภาษณ์ผู้ดูแลน้อง เพื่อค้นหาว่าอะไรทำให้สุขภาพช่องปากน้องไม่ดี โดยที่พี่จะตรวจสุขภาพช่องปากน้องดังนี้

1. ตรวจฟันและเหงือก
2. สัมภาษณ์ผู้ดูแลน้อง

หลังจากการรวบรวมข้อมูล พี่จะแจ้งให้น้องและผู้ดูแลทราบว่ามีแนวทางการปฏิบัติอย่างไรเพื่อให้มีสุขภาพช่องปากที่ดี

การเข้าร่วมโครงการวิจัยครั้งนี้ ผู้ดูแลหลักและน้องอาจปฏิเสธที่จะเข้าร่วม หรือมีสิทธิ์บอกเลิกการเข้าร่วมวิจัยเมื่อไหร่ก็ได้ โดยไม่ต้องเสียค่าใช้จ่าย พี่รับรองว่าจะเก็บข้อมูลส่วนบุคคลเป็นความลับ และการเปิดเผยข้อมูลจะทำเฉพาะกรณีจำเป็นโดยได้รับได้รับความยินยอมจากผู้ดูแลหลัก

หากน้องมีปัญหา หรือข้อสงสัยประการใด กรุณาติดต่อ ทพญ.กุลนันท์ พันธ์ศรีมังกร นิสิตปริญญาโท ภาควิชาทันตกรรมสำหรับเด็ก คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย โทร. 083-970-8988

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VITA

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After her graduation, she worked in Thammasat university hospital for two years. In 2015, she joined the graduate program in pediatric dentistry at Faculty of Dentistry, Chulalongkorn university.

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