PREVALENCE OF NON-NUTRITIVE SUCKING HABITS AMONG SAUDI CHILDREN AND ITS EFFECTS ON PRIMARY DENTITION

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ABISTRACT

The present study was carried out to: (1) investigate the prevalence of non-nutritive sucking habits in Saudi preschool children, (2) assess the influence of different factors on these habits, and (3) determine the effects of these habits on the primary dentition. A cross-sectional study was carried out using a questionnaire and clinical examination. Saudi children, aged 3-6 years were randomly selected to represent the four administrative regions of Riyadh city. The following occlusal parameters were recorded: molar terminal plane relationship, canine relationship, anterior overbite, overjet and posterior cross-bite. The study sample consisted of 515 children (248 boys and 267 girls). About 35% of them were found to have non-nutritive sucking habits; majority of whom were dummy suckers (26.2%). There were no statistically significant differences in frequencies of dummy use and /or digit-sucking habits between genders or various ages (p=0.0315 and 0.494 respectively). The prevalence of both digit and dummy sucking habits was significantly less in children who were breastfed for one year or longer (p=0.0001). A significant association was found between children's non-nutritive sucking habits and the high maternal education and family income status (p=0.0001). Unemployed mothers were found to have more children with dummy sucking habit (p=0.031). A significantly higher prevalence of all signs of malocclusion (distal molar relation, Class I canine relation, open bite, increased overjet and crossbite) were found among digit users when compared to those with no sucking habits. On the contrary, there was no significant difference between dummy users and children with no habit in the prevalence of signs of malocclusion with the exception of posterior crossbite (p=0.012). It can be concluded that children aged 3-6 years who were breastfed for one year or longer had a lower prevalence of non-nutritive sucking habits. The children of mothers with high education and from high economic status were found to have more non-nutritive sucking habits than other children. A strong effect of digit sucking habit was found on primary dentition while dummy caused posterior crossbite only.

Key words: Non-Nutritive sucking habits, Saudi children.

INTRODUCTION

Sucking reflex in infants and young children satisfies their physiological need for nutrients. Normallydeveloped infants have an inherent biological drive for sucking.¹The need for sucking can be satisfied through nutritive sucking such as during breast- and bottlefeeding, and non-nutritive sucking such as digit sucking, pacifiers or sucking on toys.² Non-nutritive sucking habit are common among young children in various populations. Several studies have investigated the prevalence of non-nutritive sucking habits and found that they vary significantly from population to population (Table 1).³⁻¹¹

The prevalence of sucking habits is believed to be influenced by certain factors such as the child's gender, rank in the family, feeding methods, socioeconomic

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status, maternal age, maternal occupation/education and race. Several studies reported that girls showed a higher level of sucking habits than boys.^{6,12-15} while some did not find any gender dilection.¹⁶⁻²⁰ The association between child's birth rank and non-nutritive habits has been discussed by several researchers. Farsi and Salama,⁸ and Infante et al¹⁵ found very weak correlation between the birth rank of the child and sucking habits. Others reported that child of later sibling rank had a greater chance of having oral habits.^{13,14,21} On the contrary, Warren et al² stated that being the first born child in the family was associated with higher prevalence of sucking habits. Dummysucking has been found to be more common in lower socio-economic groups, while children from high socioeconomic groups appeared to have an increased prevalence of digit sucking habit.^{15,22} Older maternal age and higher maternal education level were also found to be significant predictors of prolonged non-nutritive sucking habits in 2-3 years old children.² Issues such as the amount of time mothers work outside homes and their types of employment may also be associated with similar findings.^{2,11} However, such a relation was not established by other studies.8

Although sucking habits are normal in infants and young children, prolonged duration and increased intensity may have unfavorable effects on the developing orofacial structures and occlusion. Association of nonnutritive sucking habits with anterior open bite, increased overjet, Class II canine relationship, distal molar relationship and posterior crossbites in the primary dentition has been shown by several studies.²²⁻³⁰ Continuous non-nutritive sucking habits of 48 months or longer produced greater prevalence of anterior open bite, excessive overjet, narrower maxillary arch widths, posterior crossbite and smaller palatal depths.²⁵ Even when habits ceased between 24 and 36 months of age, there was increased risk of developing posterior crossbite and increased mandibular canine arch width compared to those who stopped the habit by 12 months of age.^{2,25,26} A significantly higher percentage of pacifier users than non-users had evidence of class II canine and molar relationships.^{26,30} The effect of the habit differs according to the type of the sucking habit. Both digit and dummy sucking habits had effects on the developing dentition, but dummy-sucking habits had more profound influence on the anterior and posterior occlusion than digit sucking. The effects tends to be symmetrical

when a dummy is used and asymmetrical when a digit is sucked, with the site related to digit position. 23,28,29,31

The objectives of the present study were to investigate the prevalence of sucking habits in Saudi preschool children in Riyadh city, Saudi Arabia, and to assess the influence of different factors on these habits. In addition, the study aimed to determine the effects that these habits might have on the primary dentition.

SUBJECTS AND METHODS

A cross-sectional study was conducted through a questionnaire and clinical examination. The questionnaires were sent through principals to the parents of Saudi children aged 3-6 years in eight kindergartens. The kindergartens were randomly selected to represent the four administrative regions of Riyadh city, the capital of Saudi Arabia. The number of selected children for each region was based on the number of kindergartens and children enrolled in them.

The questionnaires included covering letter explaining the nature of the study and informed parental consent for the child's participation. The following information was obtained through the questionnaire:

- Demographic information; such as child's age, gender and mother's educational status/occupation. Economic status of the family was estimated by father's occupation. The economic status was divided into three categories; high (professionals such as doctors, dentists, and businessmen); middle (governmental workers such as military, technical workers); and low (manual workers, tradesmen, farmers and unskilled workers and unemployed).³²
- History and duration of breast /bottle feeding.
- Child's past or present non-nutritive sucking habits which were expressed in terms of the type of sucking habit (digit or dummy sucking), duration of the habit in years and duration of sucking during the day, which is represented by the number of hours/day that the child practiced the habit.

The questionnaire was pre-tested in mothers of 20 children who had sucking habits (but were not part of the main study. The aim was to insure clarity of the questions. The questionnaire was modified according to the responses obtained from the mothers.

Dental examination of children

Clinical evaluation was performed in a classroom setting based on the following criteria:

- Completion of the questionnaire by parents.
- Signed informed consent form.
- Child aged 3-6 years.
- Good health and age-appropriate intellectual development.
- Presence of all 20 deciduous teeth with no erupted permanent teeth.
- No cavitated carious lesions that could result in decreased arch length.
- No ororfacial cleft or any other developmental anomalies that could affect breast feeding.
- No previous orthodontic treatment.

The occlusion was assessed while the children were sitting in an up-right position and biting in maximal intercuspation, using pen light, mouth mirror, metal millimeter rulers, gloves and masks in compliance with the international standards of infection control protocol. In all cases, the examiners were blind to the child's questionnaire data and history of non-nutritive sucking habits.

The following parameters were recorded:

- 1. Terminal plane relationship of the primary second molars, recorded as flush, mesial or distal on each side.
- 2. Primary canine relationship recorded as class I, II or III on each side.
- 3. Degree of overbite was recorded as less than or equal to 50%, greater than 50% vertical overlap of the mandibular incisor crown, edge to edge relationship or anterior openbite (measured in millimeters).
- 4. Amount of overjet measured from the lingual surface of the mesial corner of the most protruded maxillary incisor to the facial surface of the corresponding mandibular incisor recorded in millimeters (overjet in equal or more than 4 mm was designated as increased overjet).

5. Presence or absence of posterior crossbite; (either unilateral or bilateral); which was recorded when one or more of the maxillary primary molars occluded palatally to the buccal cusps of the opposing mandibular teeth.

Examiners reliability

The reliability of the examiners was evaluated after calibration with an individual expert in epidemiological studies. Inter-examiner reliability of the two examiners was tested by assessment of the occlusal characteristics of 21 primary dentition orthodontic study models. These models had been trimmed in centric occlusion relationships. Intra-examiner reliability was also tested by having each examiner evaluate the same 21 orthodontic models on two occasions separated by at least one week.

The presence of malocclusion was recorded according to the following; distal molar relation, class II canine relation, molar crossbite, anterior openbite and overjet equal or more than 4 mm.

Statistical analysis

All data were entered into computer utilizing Fox Poro Program for Windows. Statistical Package for Social Sciences (SPSS; Version #13) was utilized for all statistical computations. Frequency distribution was used for the descriptive analysis and both chi-square and z-tests were used for statistical association between the variables. The significance level was set at 0.05.

RESULTS

Intra-examiner reliability test showed complete agreement (Kappa value =1.0) in the repeated recording of all parameters for both examiners. The interexaminer agreement between the two examiners ranged from 0.82 to 0.90 using Kappa statistics for all parameters except posterior crossbite where the agreement between the two examiners reached 0.95.

A total of 515 children, 248 boys and 267 girls were examined during the study. The prevalence of digit and dummy sucking habits separately and in combination among both boys and girls are shown in Table 2. Of the total sample, 35.1% had sucking habits, with the majority of the children habitually sucking dummies (26.2%).

Authors	Year Country		Age	Sample	Habit Prevalence %		Factors associated
			0	size	Digit	Pacifier	with habits
Ravn	1976	Denmark	3	310	7	47	Not studied
Svedmyr	1979	Sweden	3-5	462	14	62	Not studied
Modeer et al.	1982	Sweden	4	588	13	31	Not studied
Larsson	1992	Norwegian	3	245	12	37	Not studied
		Sweden	3	175	18	70	Not studied
Adair et al	1995	US	2-4	218		55	Not studied
Farsi et al	1997	Saudi Arabia	3-5	583	11	38	Breast feeding duration Parents' social class
Uwaezuoke et al	2003	Nigeria	1-6	100	23		Breast feeding duration Parents' social class
Taki et al	2008	Kuwaiti	3-5	281	27	37	Breast feeding duration Parents' social class
Ngom et al	2008	Senegalese	5-6	443	16.5	17	Breast feeding duration Parents' social class

TABLE 1: CROSS SECTIONAL STUDIES OF PROLONGED NON-NUTRITIVE SUCKING HABITS

TABLE 2: PREVALENCE OF SUCKING HABITS

Habits	Boys(N=248)		Girls(N=267)	Total(N=515)	
	Ν	%	Ν	%	Ν	%
Dummy	56	22.5	79	29.6	135	26.2
Digit	24	9.7	22	8.2	46	8.9
Total	80	32.2	101	37.8	181	35.1

P value = 0.315 "chi-square test".

Slightly higher percentage of both digit and dummy suckers were girls, but the differences between gender did not reach statistical significance (p=0.315). Table 3 shows that higher frequencies of dummy users were among children of younger age and its use reduced slightly as the age of the children increased, while digit sucking habits seemed to last for longer periods of time. However, the differences between ages were not statistically significant (p=0.495). As a result of these findings, boys and girls of all ages were combined for all other statistical evaluations.

Figure 1 presents the duration of sucking which is represented by the number of hours/day that the child practices the habit. The duration of both habits was reported to be ≥ 6 hr/day in more than half of the children with a slightly higher proportion of digit users. At the time of the examination, it was found that all of the children were still active in practicing their digit/ dummy sucking habits; so all the children were included in comparative analysis.

Sucking habits and contributing factors

The prevalence of digit and dummy sucking habits according to the five contributing variables (duration of breast/bottle feeding, mother's level of education, occupation, and economic status of the family) is shown in Table 4. Children with different durations of breastfeeding were compared and it was noted that breastfeeding duration for longer than one year was associated with the lowest percentage of children who sucked



Fig 1: Duration of Sucking habits

their digits or used dummies (p=0.0001). No association was found, however, between bottle feeding and the occurrence of digit sucking habits (p=0.63). Regarding the influence of bottle feeding on the occurrence of dummy habit, it was found that children who were bottle fed for one year demonstrated the lowest percentage of using dummies, and those who were bottle fed for 2 years represented the highest proportion of dummy users, the difference between the two groups was statistically significant (p=0.019).

Mothers' education was categorized into high school or less and university or higher education. A positive association between both digit and dummy use and the higher level of mothers' education was found (p=0.0001). There was no significant differences between the children of employed and unemployed mothers in occurrence of digit habit (p=0.78). Regarding dummy use, a significantly high proportion of dummy users was found among the children of unemployed mothers (p=0.031). Family income was categorized into high, medium or low. Study results indicated that there was a strong association between the high family income and the presence of digit and dummy sucking habits (p=0.0001).

Table 5 presents the percentage distribution of different signs of malocclusion among the children

Age (Years)	N	Children with digit habit		Children with dummy habit		
		Ν	%	Ν	%	
3	56	3	5.36	17	30.4	
4	193	13	6.7	46	23.8	
5	227	25	11.0	59	26.0	
6	39	5	12.8	13	33.3	
Total	515	46	8.9	135	26.2	

TABLE 3: PERCENTAGE OF SUCKING HABITS BY AGE

P value= 0.495 "chi-square test".

Variables		Digit%	<i>P</i> -value	Dummy%	P-value
Breast-feeding	Several months 1 year 2 years > 2 years	$3.69 \\ 0.97 \\ 1.16 \\ 0.58$	0.000	9.51 1.94 3.30 0.97	0.000
Bottle feeding	Several months 1 year 2 years > 2 years	$0.78 \\ 0.19 \\ 0.58 \\ 0.58$	0.63	$2.14 \\ 0.58 \\ 3.30 \\ 2.91$	0.019
Mothers' education	High school or less University or higher	1.63 7.38	0.000	6.60 19.22	0.000
Mothers' employment status	Employed Unemployed	$3.88 \\ 5.05$	0.78	$10.68 \\ 15.35$	0.031
Family income	High Medium Low	6.02 2.33 0.58	0.000	18.25 6.99 0.97	0.000

$TABLE\,4: SUCKING\,HABITS\,IN\,RELATION\,TO\,VARIOUS\,ASSOCIATED\,VARIABLES\,(n=515)$

Statistical significance of differences between groups using chi square test.

TABLE 5: DISTRIBUTION OF DIFFERENT SIGNS OF MALOCCLUSIONS IN CHILDREN WITH SUCKING HABITS

Malocclusion Parameters	Children with no habit N=334	Children with digit habit N=46		Children with dummy habit N=135	
	%	%	<i>P</i> -value	%	<i>P</i> -value
Distal molar relation	3.89	10.87	0.037	1.48	0.180
Class II canine relation	4.19	13.04	0.012	7.35	0.153
Anterior openbite	7.18	19.56	0.005	6.66	0.842
Overjet >4	16.17	32.61	0.006	13.33	0.521
Posterior Crossbite	18.26	43.48	0.000	29.63	0.010

 $Statistical\ significant\ differences\ from\ (no\ habit)\ group\ using\ Z-test.$

TABLE 6: VARIOUS SIGNS OF MALOCCLUSIONBY AGE IN CHILDREN WITH DIGIT HABIT

Signs of Malocclusion	3 y N=5 %	4y N=3 %	5y N=13 %	6y N=25 %
Distal molar relation	—	—	8.0	—
Class II canine relation	—	7.7	20.0	—
Anterior openbite	—	15.4	24.0	20.0
Overjet>4mm	—	—	16.0	20.0
Posterior Crossbite	66.6	23.1	48.0	60.0

TABLE 7: VARIOUS SIGNS OF MALOCCLUSIONBY AGE IN CHILDREN WITH DUMMY HABIT

Signs of Malocclusion	3 y N=17	4y N=46	5y N=59	6y N=13
	%	%	%	%
Distal molar relation	—	4.3	3.4	7.7
Class II canine relation	11.8	8.7	6.8	
Anterior openbite	11.8	6.5	6.8	
Overjet>4mm	11.8	—	3.4	
Posterior Crossbite	17.7	21.8	35.5	46.0

with digit and dummy sucking habits as compared to the children with no habits using z-test for statistical comparison. A significantly higher prevalence of all signs of malocclusion was found among digit users when compared to children with no sucking habit. On the contrary, there was no significant difference between dummy users and children with no habit in the prevalence of signs of malocclusion with the exception of presence of posterior crossbite among children with dummy sucking habits (p=0.01).

Table 6 and 7 show that signs of malocclusion increased gradually with the increase in age of the children practicing digit and dummy sucking habits, and these findings were more predominant among digit users.

DISCUSSION

The present study, though a cross-sectional study carried out through a questionnaire and clinical examination, has provided useful information about nonnutritive sucking habits in Saudi preschool children. The age range of 3-6 years eliminated the children with incomplete deciduous dentition or those with mixed dentition. The questionnaire data always have to be considered with some caution. However, the questionnaire utilized by the present study was well-constructed and pre-tested before the study. A high level of intra- and inter-examiner agreements also ensured that the two examiners were using the same diagnostic criteria.

Prevalence of sucking habits

Previous prevalence studies on non-nutritive sucking habits have shown the prevalence between 33.5% to 88% in 3-year-old children.³⁻¹¹ The prevalence of digit and dummy sucking habits of the present study (35.1%) falls near the lower part of this range. The prevalence of dummy-sucking was the dominant (26.2%) as compared to digit sucking (8.9%). The findings was consistent with other studies.^{3,5,8} In contrast, it is lower than that reported by Larsson,⁶ where the dummy sucking prevalence was 70% and the digit sucking prevalence was 18%. However, Ngoam et al¹¹ findings were at odds with our results i.e. the prevalence of digit sucking was almost the same as the dummy sucking. This indicates that the prevalence is different in various populations.

Age and gender

Several studies have reported that sucking habits were more prevalent among girls,^{6,13,23} though a study showed slight male predominance.⁹ The finding of the present study showed no significant gender differences in the prevalence of digit or dummy habit, which is in agreement with other studies.^{8,30}

It is known that non-nutritive sucking habits reach its peak around 12 months of age and remain at constant level until 7 years of age,³³ however, dummy sucking is thought to decrease around the age of 4 years.² The present study showed that dummy sucking habit reduced slightly with age while the digit sucking habits seemed to last for a longer time. However, the differences between ages were not statistically significant. This can be interpreted as; the dummy suckers were likely to stop the habit with increased contact with other children. In addition, dummies can be taken away from the child to stop the habit. However, this may encourage the child to practice the digit habit if the dummy was taken away before the child is willing or able to stop non-nutritive sucking habit.⁶ According to our findings, there were no statistical significant differences in terms of age and gender; therefore, all the children were combined for further statistical evaluation.

Duration of sucking habits

Most of the children reported equal duration for both sucking habits; more than six hours a day, with slightly higher values in children with digit sucking habit. The degree of tooth displacement should correlate with the number of hours per day of sucking. Children who suck intermittently may not displace the incisors much. However, others who suck for six hour or more, especially those who sleep with the digit between teeth all night, can cause significant malocclusion.³⁴ The finding of the present study, however, was higher than that reported by Farsi et al⁸ who reported that the duration of sucking habits was 2-5 hr/ day in more than half of the children with persisting habits.

Sucking habits and contributing factors

One of the main findings of this study reveals that the breast feeding protects against the occurrence of non-nutritive sucking habits during early childhood. This finding was in accordance with previous studies.^{8,9,12,13} In this study, most children initially were breast-fed, the average feeding duration was one year, and few children were still breast feed at two years of age. The prevalence of digit and dummy sucking habits were significantly correlated with duration of breast feeding, the longer the duration of breast feeding the less likely to have the sucking habits. Early cessation of breast feeding might cause great frustration in the child, reduce maternal and child bonding and emotional satisfaction for both mother and child. In addition, a large part of sucking urge might still be unsatisfied. The result of present study also showed that the breast fed children are less prone to develop nonnutritive sucking habits than bottle fed children especially the digit sucking habit, which confirmed the result of another study.³⁵ Therefore, mothers should be encouraged to breast fed their children for a period of time as long as biologically and practically possible.

Information regarding the level of mother's education was found to be significant predictor of both dummy and digit sucking habits. The higher was the level of mother's education the more the chance of the child to have non-nutritive sucking habits. These findings were in agreement with previous studies.^{2,8} Possibly the highly educated mothers are mostly engaged in other duties outside homes, as a result, they depend on external help to care for their children. The mother's employment status had no relation with the acquisition of digit sucking habit, however, significant correlation was found between dummy sucking habits and unemployed mothers. It is known that the use of dummy is determined mostly by decision and action of mothers. These decisions and action may be influenced by different factors such as; mother's cultural background, interplay between mother and infant, and how mothers respond to infants behaviors and needs. Mothers should be warned about the harmful effects of prolonged use of non-nutritive sucking habits on children's dentition and should be instructed about the proper time for discontinuation of sucking habits, which should occur between the third and the fourth year of the child's life.^{8,20,30}

In the present study, a strong association was found between the increase of family's income and the increase in practicing of dummy and digit sucking habits. This contradict the findings of Farsi et al and Paunio et $al^{8,20}$ who found no association between economic status and sucking habits. On the other hand, Fairclough et al^{36} reported greater prevalence of dummy sucking habit among children with low socioeconomic level. The finding of the present study, however, was in accordance with the study of Calisti et al^{22} who reported that the sucking habits were significantly more frequent among children with high socio-economic status.

Effect of non-nutritive sucking habits on occlusion

The prolonged digit-sucking habit in the present study was associated with significant changes in occlusion including distal molar and Class II canine relations, anterior open bite, increase overjet, and posterior crossbite. However, among children with dummy sucking habit, a significant association was found between the use of dummies and occurrence of posterior crossbite only. Dummy habit is usually acquired earlier than digit habit, but its cessation usually happens earlier than digit-sucking habit. The long term effects of digit sucking can be more detrimental on occlusion than the dummy sucking.³⁷

The result of the present study revealed a significant correlation between the digit sucking habit and the development of distal molar (10.87%) and Class II canine (13.04%) relationships as well as increased overjet (32.61%). These findings were consistent with other studies.^{4,8,23,28,29} Proffit³⁴ explained that the consequence of the pressure from digit against upper jaw and upper teeth can cause the anterior teeth and maxilla to grow forward.

In agreement with earlier studies,^{8,30} a significant association was found between anterior open bite and digit sucking habit. The prevalence of anterior open bite in the current study (19.56%) was lower than Farsi and Salama⁸ (36%), and of Al-Jobair and Al-Emran³⁰ (55%). These differences could be attributed to the use of different diagnostic criteria and different age range which might influence prevalence outcome. The prevalence of anterior open bite tends to be higher in younger children than in six year old whose primary dentition is already complete.

Several studies have recorded an increased prevalence of posterior crossbite among finger and dummy suckers.^{6,23,31,37} In the present study, high prevalence of posterior crossbite was noted, which reached 43.48% among children with digit habit and 29.63% among dummy suckers. Similar findings were reported by Ogaard²³ and Duncan & Macnemars.³¹ Other researchers reported higher prevalence of posterior crossbite among children with dummy sucking habit than those among digit suckers.⁵ Farsi and Salama⁸ and Al-Jobair and Al-Emran³⁰ demonstrated no significant relationships between posterior crossbite and persistent non-nutritive sucking habits. Proffit³⁴ stated that digit suck-ing displaces the tongue down which creates negative pressure in the mouth causing more pressure from the cheek against upper posterior teeth, resulting in maxillary constriction and development of posterior crossbite.

The present study showed that prevalence of malocclusion increases with increase in age of the children who practice non-nutritive sucking habits. Similar findings were reported by Warren et al²⁵ whofound that practicing non-nutritive sucking habits beyond 48 months of child's age cause changes in occlusion characteristics and relationships. In addition, Bishara et al³³ stated that prolonged habit of more than 48 months with either pacifier or digit, have great effect on the occlusion in late deciduous dentition (5 years of age).

Conducting longitudinal studies is important to verify the nature of factors associated with the etiology of the non-nutritive sucking habits. The identification of these factors will help in developing and targetting prevention efforts for non-nutritive sucking habits.

CONCLUSIONS

- 1 The prevalence of dummy sucking habit was higher than digit sucking habit in the study population of Saudi preschool children.
- 2 The prevalence of digit and dummy sucking was significantly correlated with duration of breastfeeding; longer the duration of breast-feeding, less likely was the child to have the habits.
- 3 There was a strong association between the high level of mother education, and the increase in family income; with the increase in practice of dummy and digit sucking habits.

4 Prolonged digit-sucking was associated with significant occlusion changes such as distal molar and Class II canine relation, anterior open bite, increase overjet and posterior crossbite. However, dummy sucking had significant correlation with posterior crossbite only.

ACKNOWLEDGEMENT

Authors would like to express their appreciation to Dr Aminah El-Mourad and Dr Norah Sibai for their help during data collection. Thanks are also due to the Ministry of Training & Education, Principals of the participating Kindergartens, teachers, parents and children for their cooperation during the study.

The Study was registered and funded (F-1206) by King Saud University College of Dentistry Research Center(CDRC).

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