



Depth of Gingival Sulcus in Healthy Children with Erupting Permanent Teeth

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Abstract

Introduction: Measuring the gingival sulcus depth in children while their permanent teeth erupt is rather difficult especially if using reference norms for adults for a base.

Aim: Assessment of the depth of the gingival sulcus during the period of tooth eruption in healthy children.

Materials and methods: Thirty children were included in the study (age range 6 – 14 yrs). The children had good oral hygiene and no history of systemic disease. They were clinically examined – their dental statuses were taken, stages of permanent teeth eruption (up to 1/3 of the clinical crown, between 1/3 and 2/3, over 2/3, in occlusion contact), and their gingival sulcus depth was measured at 6 distovestibular, vestibular, mesiovestibular, mesiolingual, lingual, and distolingual sites using an electronic probe Parometer (Orange). It was concluded that the one with the highest value would be considered the maximum depth of the sulcus.

Results: The gingival sulcus depth in fully erupted teeth is very similar to that in healthy adults (2.20 – 0.49 mm). The change of sulcus depth in incisors and canines has a variation of 1.5 mm, which at the end of eruption is close to those in adults. Maximum sulcus depth for molars, premolars and incisors was measured distovestibularly, and for canines – mesiovestibularly.

Conclusion: At the various stages of eruption, the depth of the gingival sulcus plausibly decreases in all tooth types, and by the end of eruption it reaches a depth similar to that of the adult standard. Most indicative in regard to depth are the vestibular probing point.

Keywords

eruption, gingival sulcus, probing

INTRODUCTION

The periods of childhood and adolescence are characterized by dynamic changes in the development of the organism, related to the change of both dentitions, the formation and stabilization of the periodontium and others. The period of mixed dentition is very dynamic in relation to the changes in the oral environment, leading to an increase in the risk of oral pathology, including gingival and periodontal diseases.¹

With the eruption of permanent teeth, also the junctional epithelium, periodontal ligaments and gingival sulcus are gradually formed. This occurs during different time periods for different tooth types. This process makes the assessment of the periodontium more difficult, especially if basing it on the normal standards for adults.¹⁻⁴

Measuring the depth of the gingival sulcus with probing, the loss of junctional epithelium and bleeding during probing are the most frequently used parameters for the assessment of the periodontal status, the severity of inflammation

and the response to treatment. The assessment is carried out through the use of a periodontal probe. According to Berendregt and Carranza the periodontal probe remains the most important diagnostic tool for all periodontal diseases.⁴⁻⁶ Darby defines periodontal probing as imperative in the risk assessment for periodontal diseases and its improper execution is defined as one of the ten most common reasons for failure in dental practice.⁷⁻⁹

The use of an electronic probe of a new generation to assess the initial pathological changes during the dynamic age of puberty requires creation of standards for the children's periodontium. For children, these types of diagnostic procedures require a specific approach since there is yet no objective standards for comparison and assessment of periodontal status in healthy individuals and children with nascent periodontal diseases.

All these provide the opportunity to establish criteria for a preventative approach to periodontal healthcare of children and adolescents that is the primary goal of pediatric dentistry in this country and the subject of the present study.

AIM

Assessment of the depth of gingival sulcus during the period of tooth eruption in healthy children.

OBJECTIVES

1. Measuring the gingival sulcus depth at various stages of eruption and of different tooth types.
2. Determining the location of the maximum depth during probing for each tooth.

MATERIALS AND METHODS

Subjects of the study were 30 children between the ages of 6 and 14 (15 girls and 15 boys), undergoing the process of the formation of a permanent dentition and who did not suffer from any systemic diseases and had not had any antibiotic intake three months prior. The study was conducted on children not suffering from gingivitis – up to 25% Papilla Bleeding index Saxer & Mulheman (PBI) spread, PBI-severity <1 and with good oral hygiene (OHI<1).

The following were performed on each child:

- Registration of the dental status;
- Registration of the degree of tooth eruption, by measuring the length of the clinical crown of each tooth with a graduated periodontal probe from the marginal gingiva to the cutting edge along the axis of the clinical crown. Four groups were formed according to the degree of eruption (**Fig. 1**):
 - 1st degree – eruption up to 1/3 of the clinical crown;

- 2nd degree – eruption between 1/3 and 2/3 of the clinical crown;
- 3rd degree – eruption over 2/3 of the clinical crown;
- 4th degree – reaching contact with the antagonist.



Figure 1. Permanent teeth in varying degrees of eruption.

Measurement of the depth of the gingival sulcus was carried out with a third generation electronic probe Parometer (Orange) (**Fig. 2**). Through the electronic probe the depth of probing of the gingival sulcus of the permanent teeth in varying degrees of eruption was also measured.⁵

The probing depth for each for the permanent teeth examined was determined at six points – disto-vestibular (DV), vestibular (V), mesio-vestibular (MV), mesio-oral (MO), oral (O) and disto-oral (DO).

The deepest of the six spots examined was determined as the maximum probing depth of the respective tooth. This measurement was used as an indicator for analyzing the depth of the gingival sulcus at the respective degree of eruption of the tooth type.

The data was statistically analysed using SPSS 19 and the independent Fisher *t*-test with a 95% confidence interval ($p<0.05$).

RESULTS

1. Depth of the gingival sulcus for varying degrees of tooth eruption and different tooth types.

The data gathered in this study in determining the maximum probing depth according to the degree of eruption as grouped by tooth types is presented in **Table 1**.

During the course of eruption in the molar group the depth of the gingival sulcus decreases from 2.65 mm to 2.35 mm, and in premolars from 2.34 mm to 2.07 mm



Figure 2. A third generation electronic probe Parometer (Orange).

Table 1. Maximum depth of probing according to the degree of eruption as grouped by tooth types

	Molars		Premolars		Canines		Incisors	
	N	Mean±SD	N	Mean±SD	N	Mean ±SD	N	Mean ±SD
up to 1/3 (1)	11	2.65±0.33	22	2.34±0.19	19	2.77±0.30	11	2.86±0.81
up to 2/3 (2)	51	2.44±0.65	45	2.40±0.48	33	2.80±0.55	49	2.51±0.68
over 2/3 (3)	120	2.54±0.77	247	2.28±0.52	100	2.51±0.83	196	2.19±0.61
occ. contact(4)	214	2.35±0.53	20	2.07±0.12	21	2.03±0.48	359	2.11±0.44
Ind t-test	t (1,2) = 1.063, p = 0.292		t (1,2) = -0.473, p = 0.638		t (1,2) = -0.232, p = 0.818		t (1,2) = 1.489, p = 0.142	
	t (1,3) = 0.496, p = 0.621		t (1,3) = 0.465, p = 0.642		t (1,3) = 1.359, p = 0.177		t (1,3) = 3.499, p = 0.001	
	t (1,4) = 2.138, p = 0.047		t (1,4) = 2.213, p = 0.049		t (1,4) = 3.271, p = 0.012		t (1,4) = 3.879, p = 0.000	
	t (2,3) = 1.438, p = 0.447		t (2,3) = 1.738, p = 0.147		t (2,3) = 2.234, p = 0.042		t (2,3) = 2.438, p = 0.037	
	t (2,4) = 1.281, p = 0.236		t (2,4) = 2.542, p = 0.039		t (2,4) = 3.275, p = 0.001		t (2,4) = 3.281, p = 0.002	
	t (3,4) = 1.991, p = 0.052		t (3,4) = 0.491, p = 0.632		t (3,4) = 2.473, p = 0.040		t (3,4) = 0.191, p = 0.852	

($p < 0.05$). A similar difference in the probing depth was observed in both groups from the beginning to the end of the eruption – around 0.3 mm.

In incisors the depth of the gingival sulcus decreases from 2.86 mm to 2.11 mm, and in canines from 2.77 to 2.03 ($p < 0.05$). The change in the registered probing depth is about 0.7 mm.

2. Location of the maximum probing depth from the six points examined in each tooth

The probing depth in all the teeth of the subjects was examined at six sites – DV, V, MV, MO, O, DO. The data for the location of the deepest point for a given tooth type in the respective jaw are presented in **Tables 2, 3**.

An approximately equal depth was registered in the disto-vestibular and mesio-vestibular probing points of molars, premolars and canines of the upper jaw. For the incisor type the disto-vestibular point is the most appropriate for probing ($p > 0.05$).

In the lower jaw, the disto-vestibular probing point is most indicative for molars and incisors, while for premolars and canines the mesio-vestibular probing spot exhibits

the greatest gingival sulcus depth, which in premolars is nearly identical in depth to the disto-oral and mesio-oral probing points.

In conclusion it may be said that the disto-vestibular probing location is most indicative for determining the depth of the gingival sulcus of all teeth. Exception to this is the premolars and canines in the lower jaw for which the most accurate measurement can be taken from the mesio-vestibular probing point.

DISCUSSION

The creation of clinical criteria for the identification of pathological periodontal changes out of the physiological age specific characteristic of the periodontium during the period of eruption and stabilization of the periodontium will make possible for early diagnosing and a preventative approach in the treatment of children and adolescents, which is a primary aim of pediatric dentistry. There are not many studies in scientific literature regarding the creation

Table 2. Upper jaw – location of the maximum probing depth as grouped by tooth types

	Molars		Premolars		Canines		Incisors	
	N	%±sp	N	%±sp	N	%±sp	N	%±sp
DV(1)	54	29.0±3.33*	57	31.1±3.42*	34	43.0±5.57*	105	36.6±2.84*
V(2)	18	9.1±2.17	16	8.7±2.09	2	2.5±1.77	33	11.5±1.88
MV(3)	41	22.0±3.04*	47	25.7±3.23*	25	31.6±5.23*	75	26.1±2.59*
MO(4)	20	10.8±2.27	21	11.5±2.36	3	3.8±2.15	15	5.2±1.31
O(5)	23	12.4±2.41	17	9.3±2.15	1	1.3±1.27	11	3.8±1.13
DO(6)	30	16.1±2.70	25	13.7±2.54	14	17.7±4.30	48	16.7±2.20
Total	186	100%	183	100%	79	100%	287	100%
	t (1,3) = 1.55*		t (1,3) = 1.16*		t (1,3) = 1.49*		t (1,3) = 1.80*	

*probing spots with an approximately equal maximum depth of the gingival sulcus $p>0.05$.

Table 3. Lower jaw – location of the maximum probing depth as grouped by tooth types

	Molars		Premolars		Canines		Incisors	
	N	%±sp	N	%±sp	N	%±sp	N	%±sp
DV(1)	51	24.1±2.94*	22	14.6±2.87	27	28.7±4.67	135	41.2±2.72*
V(2)	17	8.0±1.87	4	2.6±1.31	0	0±0	30	9.1±1.59
MV(3)	38	17.9±2.63	31	20.5±3.29*	43	45.7±5.14*	87	26.5±2.46
MO(4)	48	22.6±2.87*	40	26.5±3.59*	6	6.4±2.52	22	6.7±1.38
O(5)	9	4.2±1.38	1	7±0.66	3	3.2±3.19	2	6±0.43
DO(6)	49	23.1±2.90*	53	35.1±3.88*	15	16.0±3.78	52	15.9±2.02
Total	212	100%	151	100%	94	100%	328	100%
	t (1,4) = 0.34		t (3,4) = 1.22					
	t (1,6) = 0.23		t (3,6) = 2.86					
	t (4,6) = 1.33		t (4,6) = 1.63					

*probing spots with an approximately equal maximum depth of the gingival sulcus, $p>0.05$.

of standards for the depth of the gingival sulcus during the period of eruption. The predominant notion is that at the onset of eruption the gingival sulcus undergoes significant changes and from a depth of 7-8 mm it goes to a depth of 2-3 mm and that the periodontium stabilizes long after the teeth have entered into occlusion.^{8,10-13}

This study indicates that during the period of eruption until the teeth have entered into occlusion, the gingival sulcus goes from 3.09-2.86 mm to 2.00-2.20 mm for all tooth types, with the exclusion of the molars, where it remains slightly deeper (2.36-2.34 mm). From the onset of eruption the depth remains relatively stable for molars and premolars during the various stages of eruption. In contrast, a variation in the gingival sulcus of over 1.5 mm is observed in canines and incisors, and by the end of the eruption a similar depth of the gingival sulcus to that of the other types is reached.

The results of this study are at odds with those cited in isolated articles, according to which for mandibular incisors, all canines, the first molars and the second premolars

the stabilization of the gingival sulcus occurs at the age of 12, while in all other types the stabilization is complete at the age of 16.

In that regard it can be concluded that the stabilization of the periodontium and its final formation is completed by the ages of 11-12 for the first group of teeth (6, 1, 2, 4 tooth), while for the second (3, 5, 7 tooth) by the age of 14. This gives basis to specify the indicators for using various periodontal indexes, appropriate for children.

The results of this study that the most appropriate point for probing at the lowest depth of the gingival sulcus for all teeth is the disto-vestibular location, with the exception of the premolars and canines in the lower jaw, for which the most accurate measurement can be taken from the mesio-vestibular probing point.

These locations may be used in applying some simplified indexes for the fast objectivization of the periodontal status in children and adolescents. Based on this study, such an index that takes specifically into account tooth eruption in children can be proposed.

CONCLUSIONS

1. At the various stages of eruption, the depth of the gingival sulcus decreases in all tooth types, and by the end of eruption it reaches a depth similar to that of the standard for adults.
2. Most indicative in regard to depth are the vestibular probing points.

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Глубина десневой борозды у здоровых детей с прорезыванием постоянных зубов

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Резюме

Введение: Измерение глубины десневой борозды у детей во время прорезывания их постоянных зубов довольно сложно, особенно если для сравнения используются контрольные показатели для взрослых.

Цель: Оценить глубину десневой борозды при прорезывании зубов у здоровых детей.

Материалы и методы: В исследование было включено 30 детей (в возрасте от 6 до 14 лет). Дети соблюдали хорошую гигиену полости рта и не имели в анамнезе системных заболеваний. Они были обследованы клинически – их стоматологический статус был снят, Стадия прорезывания постоянных зубов (до 1/3 клинической коронки, между 1/3 и 2/3 при окклюзионном контакте) и глубина их десневой борозды была измерена в 6 местах - дистовестибулярно, вестибулярно, мезиовестибулярно, мезолингвально, лингвально и дистолингвально с помощью электронного зонда Parometer (Orange). Был сделан вывод, что наибольшее значение измерения будет считаться максимальной глубиной борозды.

Результаты: Глубина десневой борозды полностью прорезанных зубов очень похожа на таковую у здоровых взрослых (2,20 – 0,49 мм). Изменение глубины борозды резцов и клыков имеет вариацию 1,5 мм, что в конце прорезывания близко к таковому у взрослых. Максимальная глубина борозды для моляров, премоляров и резцов измерялась дистовестибулярно, а для клыков – мезиовестибулярно.

Вывод: На разных стадиях прорезывания глубина десневой борозды, вероятно, уменьшается при всех типах зубов, и к концу прорезывания достигает глубины, аналогичной той, которая установлена у взрослого человека. Наиболее показательной с точки зрения глубины является вестибулярная точка зондирования.

Ключевые слова

прорезывание, десневая борозда, зондирование
