

Assessment of gingival sulcus depth, in primary, mixed and permanent dentition-Part-1

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Abstract

Aim and objective: The objective of this in-vivo study was to evaluate toothwise and archwise sulcus depth in human primary, mixed and permanent dentition of Indian population.

Method: The study included 40 subjects (22 males and 18 females) of an age range 4-25 years. Subjects were divided into 3 groups – the primary dentition (4-6 years) mixed dentition (7-13 years) and adult dentition (16-25 years). All the parameters were measured in upper and lower anterior segments.

Results: Gingival sulcus depth (GSD) was measured archwise and toothwise in different dentitions and overall dentition wise without differentiating archwise and toothwise. GSD was significantly higher in maxillary mixed dentition (1.75 ± 0.75) followed by permanent and primary dentition. In all the dentition, maxillary central incisor showed significant GSD.

Conclusion: The sulcus depth is maximum in mixed dentition followed by primary and permanent dentitions and significantly higher in maxillary central incisor.

Keywords: Gingival Sulcus Depth; Primary Dentition; Mixed Dentition; Permanent Dentition

1. Introduction

Gingiva is the part of masticatory oral mucosa, which covers the cervical area of teeth and alveolar process of the lower and upper jaws and acts as a strong barrier against the penetration of irritants into the periodontal tissue (Itoz & Carranza 1996). At the bottom of the gingival sulcus, junctional epithelium attaches the gingiva to the tooth surface. The gingival sulcus is a shallow V-shaped groove, on one side, which is bounded by the tooth surface and on the other side by the epithelial lining of the free gingival margin. The onset of periodontal disease is signified by the loss of attachment of the junctional epithelium from the tooth surface, resulting in a deepened gingival sulcus, also known as the periodontal pocket. Hence, sulcus depth measurement plays an important role in diagnosing periodontal disease (Pathak & Nandlal 2016). But it has some limitations because it does not detect current disease activity, but merely demonstrates the past destruction pattern.

One of the important characteristics of this sulcus is its depth. In almost all the dental procedures, the clinician is concerned for the gingival sulcus depth. Its knowledge is merely not only important for periodontal point of view for assessing the extent of periodontal detachment but also for restorative treatments (Chawla HS 1973). Hence, the operator must become concerned and informed about the changes which occur in the sulcus during life (Fuder & Jamison 1963). The perfect gingival sulcus depth is zero, but in a healthy gingiva, it was reported as 1.8 mm. In deciduous teeth sulcus depth was equal to or less than 1 mm and in permanent teeth, it is more than 1 mm. Studies have shown that the GSD in permanent teeth was greater than in

primary teeth and less than in teeth in the mixed dentition system (Srivastava B 1990, Abrishami MR 2013). The mean GSD in permanent dentition ranged from 1.12-2.91mm (Fuder & Jamison 1963). With age, changes may occur in each of these tissues; while some of these changes are caused by inflammation, others are the result of aging (U. Van der velden 1984). Thus it is imperative that children receive a periodontal examination as a part of their routine dental visits (Muller & Eger 1997).

We searched electronic databases, and hand searched bibliographies of already identified reports, as well as online sites with reports accepted for publication ahead of print for the most relevant scientific journals. We limit our search on human studies in English language. Midline search using keyword's sulcus depth, primary, mixed and permanent dentition revealed few studies. Thus this study was conducted to evaluate and compare the sulcus depth, in primary, mixed and permanent. The study protocol comprises of recording of gingival sulcus depth, attached gingiva width, and gingival thickness in primary, mixed and permanent dentition. Due to word limit, the current work is distributed in three parts. Part-1 deals with sulcus depth measurement.

2. Materials and methods

The present study was conducted in the department of periodontics and pedodontics, College of Dental Sciences, Davangere. Anterior tooth (12 teeth) with 480 sites in 40 systematically healthy subjects (22 males and 18 females, age range 4-25 yrs) was analyzed in the study. The study protocol was approved by institutional IRB (Ref. No. CODS/ 1977/2015-2016) fulfilling the criteria of RGUHS, India. Informed consent was obtained from

the parents of children and subjects involved in the study. The Primary dentition age group (4-6 years) consisted of 15 subjects; mixed dentition age group (7-13 yrs) also, consists of 15 subjects, and the adult dentition age group (16-25 years) consisted of 20 subjects. The inclusion criteria included presence of all anterior teeth in both upper and lower jaw, good oral hygiene, clinically healthy periodontal tissues with no loss of attachment. The exclusion criteria included, gingival recession in anterior teeth, known systemic disease, use of any medications possibly affecting the periodontal tissue such as phenytoin and cyclosporine A, extensive restorations.

After collecting the information about this study such as the objectives, expected outcomes, and the degree of discomfort that might occur, the subjects gave their informed consent. The selected volunteers were divided into three groups- Group A- Primary dentition, Group B- mixed dentition, Group C – permanent dentition.

In the first visit, plaque index (Silness&Loe 1964) and Gingival bleeding indexes (Ainamo& Bay 1975) were recorded followed by scaling and polishing. The measurements were done using UNC 15 periodontal probe (Hu-friedy USA) one-week post scaling. The six anterior teeth in both maxillary and mandibular arch were included.

2.1 Measurement of gingival sulcus depth (GSD): (Fig 1 and b)

The probing depth or gingival sulcus depth (GSD) was measured at the midbuccal site in maxillary and mandibular anterior regions by using a UNC-15 periodontal probe (Hu- Friedy, Chicago, U.S.A).The probe was inserted parallel to the long axis to the tooth and walked along the tooth. The probing depth was measured from the free gingival margin to the deepest penetration of the periodontal probe. The readings were recorded and rounded to the nearest millimeter (Abrishami 2013).

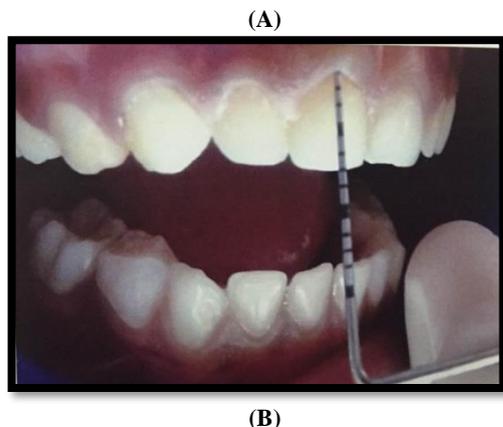


Fig. 1: Measurement of Gingival Sulcus Depth (GSD) In Maxillary and Mandibular Teeth.

2.2. Statistics

The measurements recorded were subjected to statistical analysis. Mean values and standard deviations were calculated. The ANOVA test, student 't' test and Post hoc test was used.

3. Results

Each parameter was studied in anterior teeth with 480 sites in 40 subjects (22 males and 18 females) of age group range between 4-25 years (Table 1). Gingival sulcus depth (GSD) was significantly higher ($p=0.001$) in the maxillary mixed dentition (1.75 ± 0.75) followed by maxillary permanent and primary dentition. The mandibular GSD was similar in all the dentitions. On comparing both the jaws, mixed and permanent dentition showed significantly higher GSD in maxilla (1.75 ± 0.75) and (1.33 ± 0.14) respectively than mandible whereas, primary dentition showed no significant difference (Table 2). In all the three dentition, in maxilla, GSD was significantly higher in central incisors (C.I) followed by lateral incisors (L.I) and canine (C). On interdention comparison, maxillary mixed C.I (2.2 ± 0.8) showed significantly higher ($p=0.001$) GSD followed by permanent C.I (1.4 ± 0.1) and primary CI (1.3 ± 0.4). In mandible, among all the dentitions, only in permanent dentition, central incisor (1.3 ± 0.3) showed significantly higher GSD followed by permanent lateral incisor and canine (1.2 ± 0.1) and (1.1 ± 0.4) respectively (Table 3 and 4) (Graph 1). In mixed dentition maxillary C.I (2.2mm), L.I (1.6mm) and in permanent dentition maxillary L.I (1.3mm) showed significantly higher GSD than mandibular teeth. (Table 5) The overall presentation of GSD without differentiating of archwise and toothwise showed highly significant values in the mixed dentition (1.4 mm) than primary and permanent dentition (1.2 mm) (Graph 2).

Table 1: Demographic Data

	Age(years)	Male	Female	No. of subjects
Primary	4-6	6	4	10
Mixed	7-13	7	8	15
Permanent	16-25	9	6	15
Total		22	18	40

Table 2: Sulcus Depth in Primary, Mixed and Permanent Dentition (in mm) of Maxilla and Mandible

		Primary (P)	Mixed(M)	Permanent(PM)	Anova		Tukey's post hoc
					F	P	
Mid Buccal	Max	1.18±0.39	1.75±0.75	1.33±0.14	26.71	0.001 (HS)	M>PM>P
	Mand	1.21±0.45	1.16±0.40	1.21±0.18	0.57	0.56 (NS)	
	Max vsmand	t=0.43 p=0.66 (NS)	t=6.53 p=0.001 (HS)	t=4.62 p=0.001 (HS)			

NS: Not statistically significant; S: Statistically significant ($p \leq 0.05$); HS: Highly significant ($p \leq 0.001$).

Table 3: Toothwise gingival sulcus depth, dentition wise comparison (in mm) in maxilla

	Primary (P)	Mixed(M)	Permanent(PM)	F	P value	Post hoc
Central incisor	1.3±0.4	2.2±0.8	1.4±0.1	20.11	0.001(HS)	M>PM>P
Lateral incisor	1.1±0.3	1.6±0.6	1.3±0.1	5.83	0.004 (S)	M>PM>P
Canine	1.0±0.2	1.4±0.5	1.2±0.1	7.91	0.001(HS)	M>PM>P
F	3.30	9.60	18.73			
P value	0.04(S)	0.001(HS)	0.001(HS)			
Post hoc	P>M>PM	P>M>PM	P>M>PM			

NS: Not statistically significant; S: Statistically significant ($p \leq 0.05$); HS: Highly significant ($p \leq 0.001$).

Table 4: Toothwise gingival sulcus depth, dentition comparison (in mm) in mandible

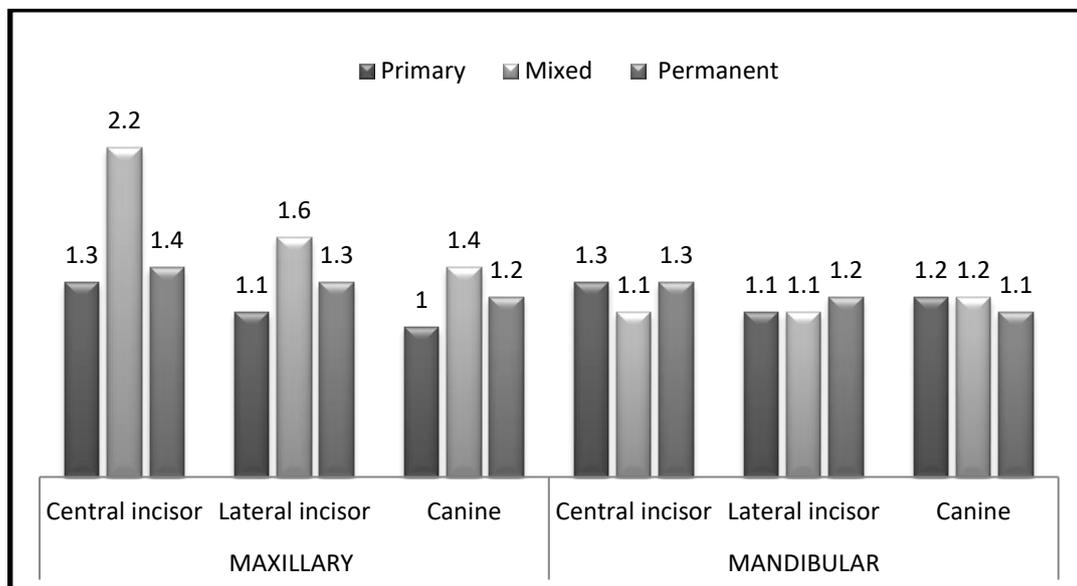
	Primary (P)	Mixed (M)	Permanent (PM)	F	P value	Post hoc
Central incisor	1.3±0.4	1.1±0.3	1.3±0.3	1.71	0.18 (NS)	
Lateral incisor	1.1±0.3	1.1±0.3	1.2±0.1	1.21	0.30 (NS)	
Canine	1.2±0.5	1.2±0.5	1.1±0.4	0.62	0.53(NS)	
F	0.55	0.81	11.8			
P value	0.57(NS)	0.44(NS)	0.001(HS)			
Post hoc			P>M>PM			

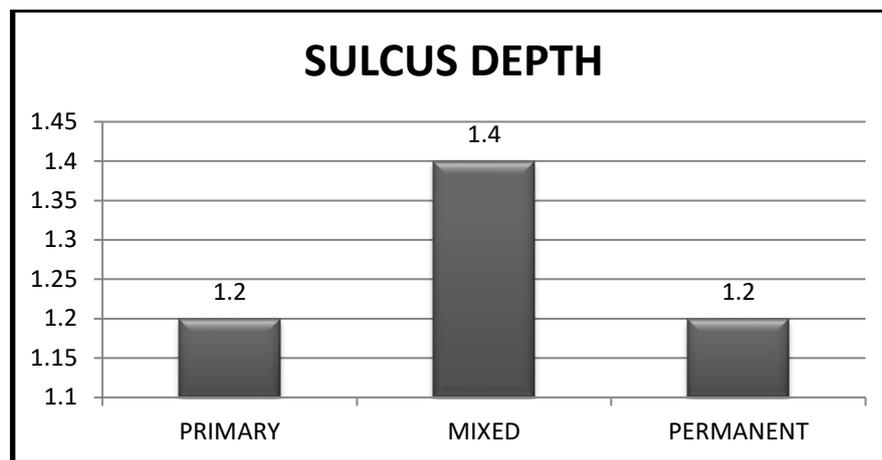
NS: Not statistically significant; S: Statistically significant ($p \leq 0.05$); HS: Highly significant ($p \leq 0.001$).

Table 5: Maxillary vs. Mandibular determination of gingival sulcus depth of each tooth gingival sulcus depth

Dentition	Tooth	Maxillary	Mandibular	T value	p value
Primary Dentition	Central incisor	1.3±0.4	1.3±0.4	0.33	0.74
	Lateral incisor	1.1±0.3	1.1±0.3	0.01	1.00
	Canine	1.0±0.2	1.2±0.5	1.17	0.24
Mixed Dentition	Central incisor	2.2±0.8	1.1±0.3	6.36	0.001 (HS)
	Lateral incisor	1.6±0.6	1.1±0.3	3.69	0.001 (HS)
	Canine	1.4±0.5	1.2±0.5	1.67	0.09
permanent Dentition	Central incisor	1.4±0.1	1.3±0.1	2.13	0.03 (S)
	Lateral incisor	1.3±0.1	1.2±0.1	3.85	0.001 (HS)
	Canine	1.2±0.1	1.1±0.1	3.26	0.002 (S)

NS: Not statistically significant; S: Statistically significant ($p \leq 0.05$); HS: Highly significant ($p \leq 0.001$).

**Graph 1:** Toothwise, dentitionwise and archwise gingival sulcus depth comparison (in mm) in maxilla and mandible



Graph 2: Overall dentitionwise measurement of sulcus depth without differentiating archwise and toothwise.

4. Discussion

The present study was aimed to measure gingival sulcus depth (midbuccally) in three periods of dentitions. The GSD of the current study demonstrated the highest sulcus depth in maxillary mixed dentition (1.75 mm) and least in mandibular mixed dentition (1.16 mm). In maxilla, the maximum GSD was observed in Central incisor (CI) of mixed dentition (2 mm) and least in the primary canine tooth (1 mm). In mandible, the maximum GSD was observed in primary and permanent central incisor (1.3 mm) and least in lateral incisor of primary and mixed dentition and canine of permanent dentition (1.1 mm). In Primary dentition CI, LI and Canine showed almost similar GSD in both jaws. In mixed and permanent dentition, maxillary C.I, LI and canine showed higher GSD than mandible.

There are few studies related to the sulcus depth (Srivastava B 1990, Abrishami 2013). Abrishami & Akbarzadeh (2013) evaluated the sulcus depth in three periods of dentition (age ranged from 3 – 15 years) and observed that mean GSD in primary dentition was 1.16 mm (max), 0.99 mm (mand); mixed 2.03mm (max), 1.43mm (mand); permanent 1.59 mm (max), 1.30mm (mand) (Abrishami MR 2013). It has been reported previously that newly erupted permanent teeth of mixed dentition showed deeper GSD than its predecessor.

Rose and App (1973) reported the higher GSD (1.48-2.75mm) in mixed dentition while in childhood and adolescence ranged between 1.06-1.96 mm in maxillary and mandibular teeth (Rose & App 1973). Study conducted by Srivastava B (1990) and kim et al (2006) also confirmed the increased sulcus depth around newly erupted permanent teeth of mixed dentition with narrower width of an attached gingiva. Different authors gave different reasons for increased sulcus depth in mixed dentition reason. It could be due to the lagging of active eruption behind the passive (Miller 1950), the lesser quality of the "primary attachment apparatus" which offers less resistance to probing (Ochsenbein 1970) and "eruption gingivitis" which allows for deeper probe penetration beyond the histological sulcus (Van der Velden. 1979). The primary dentition showed shallow gingival sulcus may be due to the small size of teeth and jaws, and a less powerful musculature in children (Pathak A 2016).

In the present study, in general the central incisors (CI) showed higher sulcus depth followed by lateral incisors (LI) and canines (C). Among different dentition, maxillary mixed central incisor (CI) showed significantly higher GSD followed by permanent and primary dentition whereas mandibular teeth showed similar GSD in C.I, LI and canine in all the dentitions. A study conducted by Bimstein E. (1988) on 54 children aged 7 to 9 years to evaluate the changes in the sulcus probing depth during the mixed dentition period and results showed higher GSD in permanent teeth than primary in mixed dentition period and in Permanent dentition, maxillary central incisors (2.7mm) showed higher GSD than pri-

mary CI (1.7 mm) (Bimstein and Eidelman 1988). The fact that the maxillary teeth had a greater sulcus depth than the mandibular teeth may be explained by the differences in the ages of tooth eruption and the eruption process itself ((Pathak A 2016).

The present study results are not comparable with the above studies due to difference in age groups, dentitions and arches studied.

To summarize the current study, the arch wise and tooth wise assessment of gingival sulcus depth (GSD), in each dentition were done. The overall presentation includes dentition wise presentation of data without discriminating as teethwise and archwise to ease the clinical presentation of data in general. If any specific consideration is required, individual tooth arch wise data is presented in the current study for the first time which is extensive and clinically exhaustive.

5. Clinical transfer of the study

The mixed dentition period is a transient phase. The variation in the sulcus depth is only for a temporary period. Hence any therapeutic correction of sulcus depth should never be attempted.

6. Conclusion

Early diagnosis is important for successful treatment. Hence, measuring the gingival sulcus depth is among the prime importance in determining the early onset of periodontal destruction. In present study, gingival sulcus depth is higher in mixed dentition (1.4 mm), followed by permanent (1.2 mm) and primary dentition (1.2 mm). Among all the three dentitions, maxillary mixed dentition showed higher GSD whereas in mandibular arch it was similar in all the dentitions.

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