*International Journal of Dental Research*, 5 (2) (2017) 125-129

**International Journal of Dental Research**

*Website: www.sciencepubco.com/index.php/IJDR*
*doi: 10.14419/ijdr.v5i2.7955*
***Research paper***

# Assessment of gingival thickness in primary, mixed and permanent dentition: part 3

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## Abstract

**Aim and objective:** The objective of this in-vivo study was to evaluate gingival thickness of mid buccally and interdentally in primary, mixed & permanent dentition.
**Method:** The study included 40 subjects (22 males and 18 females) with 480 sites 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 thickness (GT) was measured arch wise and tooth wise in different dentition and overall dentition wise without differentiating arch wise and toothwise. Gingival thickness (GT) was significantly higher (p=.001) in mixed dentition midbuccally (1.3 $\pm$0.46) and interdentally (2.31$\pm$0.71) in both the arches. GT (MB) was significantly higher in primary dentition (1.4$\pm$0.5) and GT (ID) was significant in mixed dentition (2.6$\pm$0.7).
**Conclusion:** Gingival thickness increases from primary to mixed dentition and significantly higher in maxilla.

***Keywords***: *Gingival Thickness; Primary Dentition; Mixed Dentition; Permanent Dentition*

## 1. Introduction

The gingival unit is subject to morphological changes due to normal pattern of oral development. It has long been known that this clinical appearance of the marginal periodontium differs from subject to subject and even among different tooth types. Many features are genetically determined, others seem to be influenced by tooth size, shape and position and biological phenomenon such as gender, growth and age (Muller & Eger 1997).As far as the periodontium is concerned, many investigators have found that the degree of periodontal breakdown increases with increasing age (Schei. O et al 1959). 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).
In recent years, the dimensions of different parts of masticatory mucosa, especially gingival thickness (GT) has become a subject of considerable interest in periodontics, both from a epidemiologic and a therapeutic point of view (Muller & Eger 2002).
The term gingival or periodontic phenotype has been coined (Müller & Eger 1997) to address a common clinical observation of great variation in thickness and width of facial keratinized tissue (Müller & Eger 1997).It was observed that increase amount of recession is followed in subject with thin and vulnerable gingiva following non surgical periodontal ligament therapy. Anderegg and Metzler also (1995)confirmed this observation in their study and concluded that there is less post gingival recession ($P < 0.001$) for tissue thickness >1 mm than ≤1 mm(Uchida H et al 1989).
In the literature, the thickness of a masticatory mucosa is evaluated by both invasive and non- invasive methods. The invasive method of assessing masticatory mucosa includes conventional histology on cadaver jaws, while a few others used injection needle or probe, histologic sections or cephalometric radiographs (Studer et al 1997). Although the thickness was assessed by the bone sounding technique or the transgingival probing method in dentate subjects, only the palatal masticatory mucosa was evaluated (Muller et al 2000). Furthermore, the assessment of facial gingival thickness by transgingival probing into human subjects, and the correlation with the age, gender and dental arch in the anterior segment is scanty. Vandana and Savita in 2005 have reported that the younger age group of 16-24 years demonstrated significantly thicker gingiva than that of the older age group of 25-38 years (Vandana KL & Savitha 2005). Since studies have concluded that the gingival thickness plays a vital role in development of mucogingival problems and in success of treatment for recession (Carlo B 1999) and wound healing, (Anderegg 1995) hence assessment of gingival thickness is relevant.
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. Medline search using keyword's gingival thickness, primary, mixed and permanent dentition revealed few studies. There is lack of studies on assessment of gingival thickness in all the three dentitions. Thus this study (Part 3) was conducted to evaluate and compare the gingival thickness midbuccally and interdentally, in primary, mixed and permanent dentition. The actual study 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. Measurement of sulcus depth and attached gingiva width in three dentitions is conducted in part 1 and part 2 respectively.

## 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 years) also consisted 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 among three groups- Group A- Primary dentition, Group B- mixed dentition, Group C – permanent dentition. (As mentioned in part 1 and part 2)

In the first visit, plaque index (Silness & Loe 1964) and gingival bleeding index (Ainamo and Bay1975) 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 thickness (GT): (Fig 1)

The gingival thickness (GT) was assessed mid facially by transgingival probing in the attached gingiva, half-way between the mucogingival junction and free gingival groove (vandana KL et al 2005) and at the base of an interdental papilla (Vandana KL & Savitha 2005). The GT was assessed by anaesthetizing the facial gingiva with xylonor spray (lignocaine 15g) and if required filtration was conducted using 2 % lignocaine HCL with 1:80,000 adrenaline injection. GT was assessed after 20 mins of injection using UNC 15 probes. Measurements were not rounded off to the nearest millimetre.

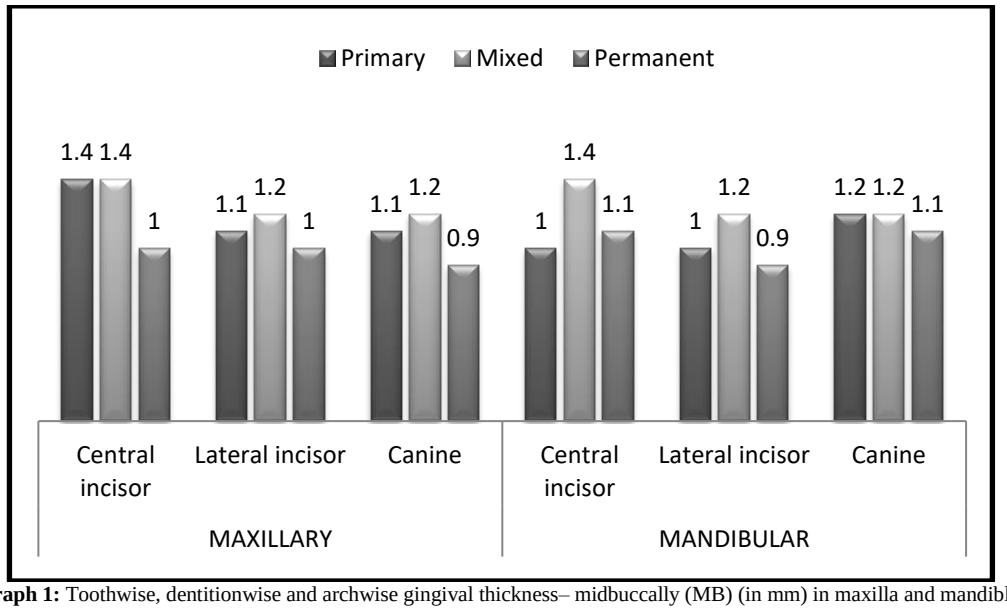
**Fig. 1:** Measurement of Gingival Thickness (GT)

### 2.2. Statistics

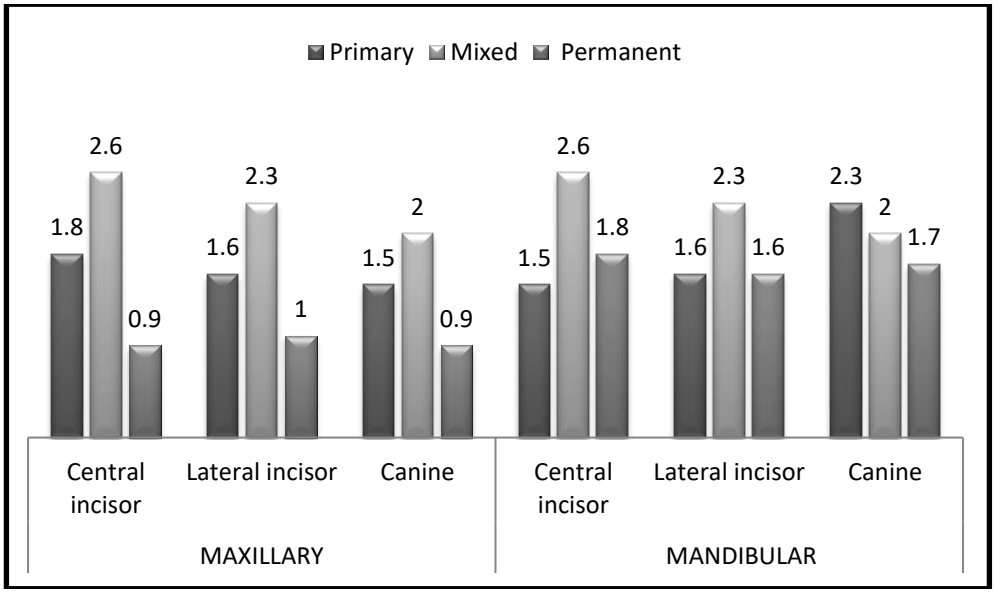
The measurements recorded were subjected to statistical analysis. Mean values and standard deviations were calculated. The ANOVA, Student‘t’ test and Post hoc test was used to compare the transgingival probing measurements, midbuccally and at the interdental papillary region.

## 3. Results

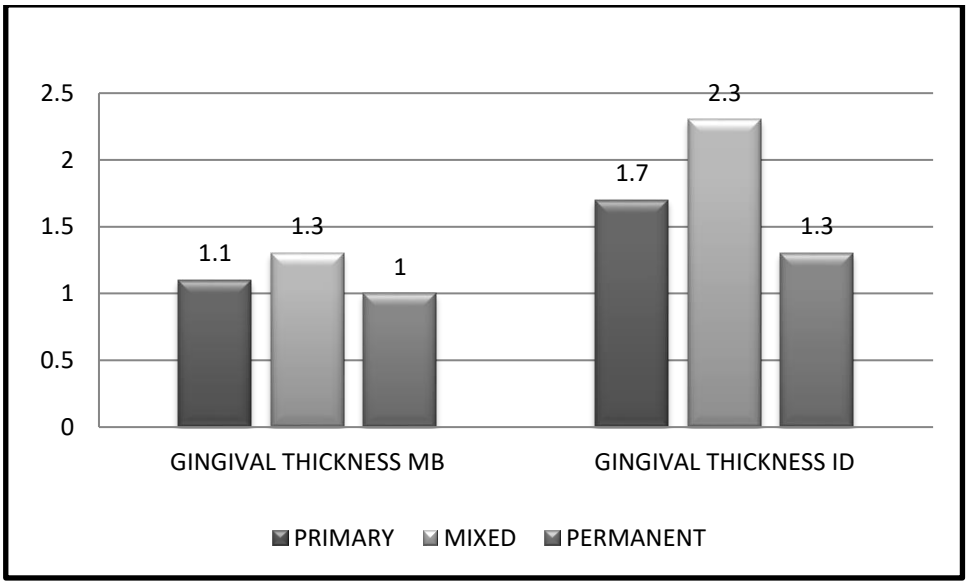
Each parameter was studied in anterior teeth with 480 sites in 40 subjects (22 males and 18 females) of age group range between 4-25 yrs (Table 1). Gingival thickness (GT) was significantly higher (p=.001) in maxillary mixed dentition both midbuccally (1.3 ±0.46) and interdentally (2.31±0.71) than primary and permanent dentition. On comparison between the arches within the dentition, Primary dentition showed significantly higher (P=.001) midbuccal gingival thickness (MBGT) in maxillary (1.2±0.4) than mandibular (1.06±0.25) arch. In mixed dentition, similar midbuccal and interdental GT was seen similar in both the arches. In permanent dentition, mandible (1.74±0.69) showed significantly higher GT than maxilla (0.93±0.3) (Table 2). In all the 3 dentitions, in the maxilla midbuccal gingival thickness (MBGT) was higher in central incisor followed by lateral incisor and canine but the difference was significant in primary dentition. On inter dentition comparison, central incisor of maxillary primary and mixed dentition (1.4±0.5) was significantly higher than permanent central incisor (1.0±0.2) whereas in mandible, mixed dentition central incisor (1.4±0.5) showed significantly higher MBGT than primary and permanent dentition. Within a dentition, mandibular canine (1.2±0.4) of primary dentition, and central incisor (1.4±0.5) of mixed dentition, showed significantly higher MBGT than other two teeth in mandibular arch (Graph 1). Interdental gingival thickness (IDGT) was significantly higher (p=.001) in CI, LI and canine of mixed dentition followed by primary and permanent dentition. Interdentally maxillary mixed Central incisor (2.6± 0.7) showed significantly higher (p=.001) IDGT followed by maxillary mixed Lateral incisor (2.3±0.6) and canine (2.0±0.6). In mandible significant IDGT (p=.001) was found in mixed dentition central incisor (2.6±0.7) (Graph 2). On comparing maxillary and mandibular anterior teeth of three dentitions, only maxillary C.I (1.4mm) of primary dentition showed significantly higher MBGT than mandibular C.I and interdentally, mandibular canine (2.3mm) of primary dentition showed significantly higher IDGT (Table 3 and 4). The overall presentation of gingival thickness without differentiating of arch wise and tooth wise showed highly significant values in the mixed dentition both midbuccally (1.3±0.4 mm) and interdentally (2.3±0.7 mm) followed by primary and permanent dentition (Graph 3).




**Graph 1:** Toothwise, dentitionwise and archwise gingival thickness– midbuccally (MB) (in mm) in maxilla and mandible.




**Graph 2:** Toothwise, dentitionwise and archwise gingival thickness– interdentally (ID) (in mm) in maxilla and mandible.




**Graph 3:** The Dentitionwise overall presentation of gingival thickness without differentiating archwise and toothwise.

**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:** Gingival Thickness 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 | 1.20±0.40 | 1.30±0.46 | 1.00±0.30 | 12.90 | 0.001 (HS) | M>P>PM |
| | Mand | 1.06±0.25 | 1.30±0.46 | 1.08±0.36 | 9.43 | 0.001 (HS) | M>P=PM |
| | Max vs mand | t=2.17 P=0.001 (HS) | t=0.001 P=1.00 (NS) | t=1.66 P=0.09 (NS) | | | |
| Interdental | Max | 1.66±0.54 | 2.31±0.71 | 0.93±0.30 | 141.48 | 0.001 (HS) | M>P>PM |
| | Mand | 1.83±0.71 | 2.31±0.71 | 1.74±0.69 | 16.11 | 0.001 (HS) | M>P=PM |
| | Max vs mand | t=1.14 P=0.15 (NS) | t=1.00 P=1.00 (NS) | t=10.04 P=0.001 (HS) | | | |

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

**Table 3:** Maxillary vs. Mandibular Determination of Gingival Thickness – Midbucally (MB) of Each Tooth Gingival Thickness – MB

| Dentition | Tooth | Maxillary | Mandibular | T | P value |
|---|---|---|---|---|---|
| Primary Dentition | Central incisor | 1.4±0.5 | 1.0±0.0 | 3.55 | 0.001(HS) |
| | Lateral incisor | 1.1±0.3 | 1.0±0.0 | 1.45 | 0.15 |
| | Canine | 1.1±0.3 | 1.2±0.4 | 0.87 | 0.38 |
| Mixed Dentition | Central incisor | 1.4±0.5 | 1.4±0.4 | 0.62 | 0.53 |
| | Lateral incisor | 1.2±0.4 | 1.2±0.4 | 0.40 | 0.68 |
| | Canine | 1.2±0.4 | 1.2±0.4 | 2.84 | 0.07 |
| Permanent Dentition | Central incisor | 1.0±0.2 | 1.1±0.3 | 0.50 | 0.61 |
| | Lateral incisor | 1.0±0.3 | 0.9±0.3 | 1.84 | 0.07 |
| | Canine | 0.9±0.2 | 1.1±0.4 | 0.01 | 1.00 |

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

**Table 4:** Maxillary vs. Mandibular Determination of Gingival Thickness Interdentally (ID) of Each Tooth Gingival Thickness – ID

| Dentition | Tooth | Maxillary | Mandibular | T | P value |
|---|---|---|---|---|---|
| Primary Dentition | Central incisor | 1.8±0.5 | 1.5±0.6 | 1.29 | 0.20 |
| | Lateral incisor | 1.6±0.4 | 1.6±0.6 | 0.01 | 1.00 |
| | Canine | 1.5±0.6 | 2.3±0.5 | 4.03 | 0.001(HS) |
| Mixed Dentition | Central incisor | 2.6±0.7 | 2.6±0.7 | 0.66 | 0.50 |
| | Lateral incisor | 2.3±0.6 | 2.3±0.6 | 1.21 | 0.23 |
| | Canine | 2.0±0.6 | 2.0±0.6 | 0.25 | 0.80 |
| Permanent Dentition | Central incisor | 0.9±0.3 | 1.8±0.7 | 1.64 | 0.10 |
| | Lateral incisor | 1.0±0.4 | 1.6±0.6 | 1.21 | 0.23 |
| | Canine | 0.9±0.2 | 1.7±0.6 | 1.38 | 0.17 |

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

## 4. Discussion

In several clinical situations information on thickness of the masticatory mucosa are highly desirable. A thin and delicate gingiva might be prone for developing gingival recessions after traumatic surgical or inflammatory injury's, likewise, orthodontic tooth movement may also have detrimental influence on the mucogingival complex, especially at sites where keratinized tissue and underlying bone appear to be thin.

In the current study, mixed dentition showed significantly higher gingival thickness both midbuccally (1.3 mm) and interdentally (2.3 mm) than primary and permanent dentition in both the arches. The least GT was found in maxillary permanent dentition both midbucally (1 mm) and interdentally (0.93 mm). In the primary dentition, maxilla showed significantly higher MBGT than mandible. However, in mixed and permanent dentition, MBGT was found to be similar in both the arches. Contrary to the MBGT, IDGT was higher in the mandible.

In maxilla, MBGT was maximum in C.I (1.4 mm) of mixed dentition. Minimum GT was found in canine (0.9 mm) of permanent dentition. In mandible, the MBGT was maximum in C.I (1.4 mm) of mixed dentition. Minimum MBGT was found in L.I (0.9 mm) of permanent dentition. In maxilla, IDGT was maximum in C.I (2.6 mm) of mixed dentition. Minimum GT was found in C.I and canine (0.9 mm) of permanent dentition. In mandible, the IDGT was maximum in C.I (2.6 mm) of mixed dentition. Minimum IDGT was found in C.I (1.5 mm) of primary dentition.

There are few studies related to gingival thickness in all the three dentitions. Thickness mainly depends on tooth type and is correlated with width of the gingiva. A study conducted on 200 subjects on 3 age groups (20-25, 40-45, 55-60 years) showed that in the maxilla, mean GT varied between 0.9 mm (canines and 1st molars) and 1.3 mm (2nd molars) and in the mandible GT ranged between 0.8 mm (canines) and 1.5 mm (2nd molars) (Eger T 1996). Gingival thickness varies with age, gender and dental arch location. Vandana K. L and Savita in 2005 in their study on 32 subjects of age group 16–38 years determined the thickness of facial gingiva through transgingival probing in the maxillary and mandibular anteriors. The younger age group of 16-24 years demonstrated significantly thicker gingiva (1.63 and 1.73 mm mid-buccally and 1.59 and 1.78 mm inter-dentally) than that of the older age group of 25-38 years, (0.97and 1.03 mm mid-buccally and 0.93 and 1.07 mm interdentally (Vandana KL & Savitha 2005).Younger age group had significantly thicker gingiva than that of the older age group, it might be because of changes in the

oral epithelium caused by age, related to thinning of the epithelium and diminished keratinisation (U. Van der velden 1984).

Thick gingival tissue is probably the representation most associated with periodontal health in which the tissue is dense in appearance with a fairly large zone of attachment and relatively thick underlying osseous forms. The gingival topography is relatively flat with the suggestion of a thick underlying bony architecture. Thin gingival tissue tends to be delicate, friable and almost translucent in appearance with a minimal zone of the attached gingiva. The osseous architecture associated with this gingival tissue type is characterized by fenestration and dehiscence (Richard T et al 2005).

Frost in 2015 conducted a study to relate the gingival thickness with probe visibility and with buccal plate thickness. Probe becomes invisible when the gingival thickness was >0.8mm. When the probe was visible, mean gingival thickness was 0.17mm less compared to the "thick" counterparts. When the probe was visible, mean buccal plate thickness was tended to be smaller by 0.212 mm (Frost NA et al 2015).

There may be other confounding factors that influence gingival thickness such as racial and genetic factors (Waraaswapati 2001) The gingiva was found to be thinner in females than males and, in the mandibular arch than the maxilla (Vandana KL & Savitha 2005). Palatal mucosa may be thin in subjects with a thin and narrow gingiva and a slender shape of upper front teeth (Müller HP 2000). A study performed in younger (14- 21 yrs) and older age group (30- 59 yrs) reported thinner palatal mucosa 2.8 ± 3.0 mm in younger age group than older age group 3.1 ± 3.0mm (Waraaswapati 2001).

The assessment and comparison of gingival thickness in adult dentition have been attempted by few authors (Vandana KL & Savitha 2005, Kolte R et al 2014) but for the first time it's been attempted in primary and mixed dentition. Archwise and toothwise measurement of GSD and GT in all the three dentition also have been attempted for the first time.

A review paper on gingival thickness is clinically useful [review to be published].The clinical implication of gingival thickness on post operative flap surgery healing is evident in a published paper by (Vandana KL and Ira Gupta 2016).

To summarize the current study, the archwise and toothwise assessment of gingival thickness (GT) was done. The overall presentation includes measurements of all the teeth in maxilla and mandible 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 which is extensive and clinically not feasible.

## 5. Clinical transfer of the study

Gingival thickness is important from the point of perio-esthetics and restorative aesthetics. The due consideration for gingival thickness measurement should be kept in mind to minimize post aesthetic consequences. It helps in understanding the treatment outcome meaningfully. It should be mandatory to record GT for all periodontal surgical procedures as the common outcome such as recession depends on the gingival thickness.

## 6. Conclusion

The Gingival thickness varies with tooth sites, dentition wise and arch wise in all the three dentitions. It was higher in mixed dentition both mesiobucally (1.3 mm) and interdentally (2.3 mm) followed by primary (1.1 mm MB and 1.7 mm, ID)and permanent dentition (1.0 mm, MB and 1.3 mm, ID). The arch wise and anterior tooth wise data presentation is useful in these clinical issues to delineate healthy and disease status of gingiva.

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