Journal of Periodontology

Thickness of gingiva in association with age, gender and dental arch location

Vandana KL, Savitha B. Thickness of gingiva in association with age, gender and dental arch location. J Clin Periodontol 2005; 32: 828–830. doi: 10.1111/j.1600-051X.2005.00757.x. © Blackwell Munksgaard, 2005.

Abstract

Background: It has been long known that the clinical appearance of healthy 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 phenomena such as gender, growth and age. **Aim:** The purpose of this study was to determine the thickness of facial gingiva among Indians and its association with age, gender and dental arch.

Methods: The study group included 16 males and 16 females with an age range of 16–38 years. Gingival thickness was assessed in the maxillary and mandibular anteriors by transgingival probing.

Results: It was observed that the younger age group had significantly thicker gingiva than that of the older age group. The gingiva was found to be thinner in females than males and, in the mandibular arch than the maxilla.

Conclusion: In the present study, it was concluded that gingival thickness varies according to age, gender and dental arch.

K. L. Vandana and B. Savitha

Department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India

Key words: age; dental arch; gender; gingival thickness; transgingival probing

Accepted for publication 10 January 2005

In recent years, the dimensions of different parts of the masticatory mucosa, especially gingival thickness, has become a subject of considerable interest in periodontics both from an epidemiologic and a therapeutic point of view. Normally, there is a considerable intra-individual and inter-individual variation in both width (Seibert & Lindhe 1989) and thickness of the facial gingiva (Olsson & Lindhe 1991), a fact that gives rise to the assumption that different gingival phenotypes might exist in any adult population.

It has long been known that the clinical appearance of the healthy 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 phenomena such as gender, growth and age (Muller & Eger 1997).

In the literature, the thickness of masticatory mucosa is evaluated by both invasive and non-invasive methods. The invasive method of assessing masticatory mucosa includes conventional histology on cadaver jaws (Schluger et al. 1990). while a few others used injection needle, or probe (Pedelton 1934, Goaslind et al. 1977, Claffey & Shanley 1986, Olsson & Lindhe 1991), histologic sections (Anderegg et al. 1995) or cephalometric radiographs (Ostlund 1958).

Although several studies have previously investigated the thickness of palatal masticatory mucosa, the majority of subjects were edentulous, who had complete dentures, and the thickness was assessed non-invasively using ultrasonic device (Lytle 1957, Daly & Wheeler 1971, Terakura 1986, Jan 1987, Uchinda et al. 1989, Carlo 1999). Although the thickness was assessed by the bone sounding technique or the transgingival probing (TGP) method in dentate subjects, here, only the palatal masticatory gingiva was evaluated (Eger et al. 1996, Muller 2000). Furthermore, the assessment of the facial gingival thickness by TGP in human subjects, and the correlation of the gingival thickness with age, gender and dental arch in the anterior segment is scanty.

Hence, this study was conducted to determine the thickness of facial gingiva of anterior segments in Indian subjects aged 16–38 years by TGP. The association of age, gender and dental arch with the thickness of gingiva was also investigated.

Materials and Methods

The review committee constituted by the Rajiv Gandhi University of Health Sciences approved the protocol for human subjects. Thirty-two systemically healthy Indians (16 males, 16 females, age range 16–38 years) participated in this study. The younger age group (16–24 years) consisted of 15 subjects, with a mean age of 20 years and 17 subjects in the older age group (25–38 years), with a mean age of 31.5 years. The inclusion criteria were (a) healthy periodontal tissues with no loss of attachment, and (b) presence of all anterior teeth in both upper and lower jaw. The following exclusion criteria were considered (Waraaswapati et al. 2001): (a) pregnancy and lactation, (b) gingival recession in the anterior teeth, (c) systemic disease, (d) extensive restorations, and (e) use of any medication possibly affecting the periodontal tissues such as cyclosporin A, calcium channel blockers and phenytoin.

After collecting information about this study such as the objectives, expected outcomes, and the degree of discomfort that might occur, the subjects gave their informed consent. In the first visit, plaque index (Silness & Loe 1964) and gingival bleeding index (Ainamo & Bay 1975) were recorded followed by scaling and polishing.

Procedural steps for measurement of gingival thickness

The gingival thickness was assessed midbuccally in the attached gingiva, half way between the mucogingival junction and free gingival groove (Goaslind et al. 1977) and at the base of the inter-dental papilla. The measurement points on the facial gingiva were marked with a marking pencil, Fig. 1. The gingival thickness was assessed by anaesthetizing the facial gingiva with xylonar spray (Lignocaine 15.0 g) and if required, infiltration was conducted using 2% lignocaine HCl with 1:80,000 adrenaline injection; using a UNC-15 probe, the gingival thickness was assessed 20 min. after injection. Measurements were not rounded off to the nearest millimetre.

The measurements recorded were subjected to statistical analysis. Mean values and standard deviations were calculated. The paired *t*-test was used to compare the



Fig. 1. Location of 24 measurement points [•] for assessment of thickness of gingiva at the mid-buccal and inter-dental papillary region.

TGP measurements, mid-buccally and at the inter-dental papillary region.

Results

Tables 1–3 present the mean scores of the gingival thickness at the subject level. The mean thickness of the gingiva mid-buccally ranged between 1.63 (± 0.34) and 1.73 (± 0.37) mm and between 1.59 (± 0.33) and 1.78 (± 0.41) mm at the inter-dental papilla in the younger age group (16-24 years). The mean thickness of the gingiva midbuccally in the maxillary and mandibular arches ranged between 0.97(\pm 0.29) and 1.03 (± 0.31) mm and between 0.93 (0.37) and 1.07 (\pm 0.40) mm at the interdental papilla in the older age group (25-38 years). Comparison of the gingival thickness at the mid-buccal and inter-dental papillary region between the age groups indicated that the gingiva was significantly thicker in the younger age group than the older age group (p < 0.001), Table 1. On comparison of gingival thickness between males and females at both sites, female volunteers had thinner gingiva than males, but the difference was statistically significant only in the mandibular inter-dental papillary region (p < 0.02), Table 2. On comparison between the maxillary and the mandibular arch at the mid-buccal and inter-dental papillary region, the mandibular arch showed a thicker gingiva both mid-buccally (1.07 mm) and in the inter-dental papillary region (1.13 mm) compared with the maxillary arch. However, the difference was statistically significant only in the mandibular inter-dental papillary region (p < 0.001), Table 3.

Discussion

In recent years, the dimensions of different parts of the masticatory mucosa, especially gingival thickness, has become the subject of considerable interest in periodontics from both an epidemiologic and a therapeutic point of view. Since studies have concluded that the thickness of the gingiva plays a vital role in development of mucogingival problems and in the success of treatment for recession (Carlo 1999) and wound healing (Anderegg et al. 1995), assessment of gingival thickness is relevant to clinical periodontics.

The thickness of masticatory mucosa is evaluated by invasive methods using injection needle, probe (Pedelton 1934, Goaslind et al. 1977, Claffey & Shanley 1986, Olsson et al. 1993), histologic sections (Anderegg et al. 1995), or cephalometric radiographs (Ostland 1958). The thickness of masticatory mucosa has also been evaluated by non-invasive methods such as ultrasonic devices (Lytle 1957, Daly & Wheeler 1971, Terakura 1986, Jan 1987, Uchinda

Table 1. Mean gingival thickness (\pm SD) in millimetres between the younger (16–24 years) and older (25–38 years) age group at mid-buccal location and inter-dental papilla

| | 16–24 years (mean \pm <i>SD</i>) | 25–38 years (mean \pm <i>SD</i>) | Difference between age groups | |
|-------|-------------------------------------|-------------------------------------|----------------------------------|-----------------|
| | | | Z | <i>p</i> -value |
| MB | | | | |
| Max. | 1.63 ± 0.34 | 0.97 ± 0.29 | 1.32 | < 0.001 HS |
| Mand. | 1.73 ± 0.37 | 1.03 ± 0.31 | 12.9 | <0.001 HS |
| IDP | | | | |
| Max. | 1.59 ± 0.33 | 0.93 ± 0.37 | 10.6 | <0.001 HS |
| Mand. | 1.78 ± 0.41 | 1.07 ± 0.40 | 10.1 | <0.001 HS |
| | | | | |

MB, mid-buccal; IDP, inter-dental papilla; max., maxillary; mand., mandibular.

Table 2. Mean gingival thickness (\pm SD) in millimetres between males and females

| | Male (mean \pm <i>SD</i>) | Female (mean \pm <i>SD</i>) | M versus F | |
|-------|------------------------------|--------------------------------|------------|-----------------|
| | | | Ζ | <i>p</i> -value |
| MB | | | | |
| Max. | 0.99 ± 0.28 | 1.00 ± 0.35 | 0.2 | 0.84 NS |
| Mand. | 1.11 ± 0.35 | 1.02 ± 0.33 | 1.67 | 0.10 NS |
| IDP | | | | |
| Max. | 0.96 ± 0.38 | 0.94 ± 0.33 | 0.32 | 0.75 NS |
| Mand. | 1.22 ± 0.38 | 1.06 ± 0.42 | 2.29 | 0.02 S |

MB, mid-buccal; IDP, inter-dental papilla; max., maxillary; mand., mandibular.

Table 3. Mean gingival thickness (\pm SD) in millimetres between the maxillary and mandibular arch

| | Max. | Mand. | Max. versus mand. | | |
|-----|------------------|------------------|-------------------|------|-----------------|
| | (mean $\pm SD$) | (mean $\pm 5D$) | mean difference | Ζ | <i>p</i> -value |
| MB | 1.00 ± 0.32 | 1.07 ± 0.34 | 0.07 | 1.75 | 0.08 |
| IDP | 0.95 ± 0.35 | 1.13 ± 0.41 | 0.18 | 3.60 | <0.001 S |

MB, mid-buccal; IDP, inter-dental papilla; max., maxillary; mand., mandibular.

et al. 1989, Carlo 1999). Although the ultrasonographic method of assessing gingival thickness is non-invasive, drawbacks included the relative unavailability of the instrument, difficulty in maintaining the directionality of the transducer (Daly & Wheeler 1971), and non-reliable results when the thickness of gingiva exceeds 2–2.5 mm (Eger et al. 1996). Hence, to overcome these problems, conventional TGP was utilized to assess the thickness of gingiva in the present study.

Although several studies have previously investigated the thickness of palatal mucosa by TGP and only a few reported the thickness of facial gingiva using the same method, the present study was undertaken to evaluate the association of gender, age, and dental arch with the thickness of gingiva in Indian population.

Analysis of gingival thickness at both sites, i.e. mid-buccal and inter-dental papilla, indicated that the gingiva was thicker in the younger age group than the older age group. There are no studies wherein agewise comparisons of facial gingival thickness in the anterior segment are reported. Hence, the palatal mucosa as observed by Waraaswapati et al. (2001) was taken for comparative reference, who reported that the thickness of palatal masticatory mucosa was thicker in younger than older subjects, which might be because of the increased keratinization associated with age, and presence of submucosal layer, which contains adipose tissue and small mucous glands. However, the present study has shown the gingiva to be thicker in the younger age group than the older age group, a finding that might be because of changes in the oral epithelium caused by age, related to thinning of the epithelium and diminished keratinization (Van der Velden 1984). There may be other confounding factors that influence gingival thickness such as racial and genetic factors (Waraaswapati et al. 2001) that need to be investigated further.

Gingival thickness has been reported to be thinner in female volunteers than

male volunteers, similar to the finding of Muller (2000). In the present study, dental arch comparison of gingival thickness demonstrated thicker gingiva in the mandible than in the maxilla. The mandibular midbuccal and papillary gingiva was thicker than the maxillary gingiva. This is in contrast to the results of Muller (2000), who found the gingiva to be thicker in the maxilla than in the mandible, with the thinnest facial gingiva found at maxillary canines as well as mandibular 1st premolars.

Within the limits of the present study, it is demonstrated that younger subjects have significantly thicker mucosa than older subjects. Females exhibited a thinner gingiva as compared with males. On comparison of gingival thickness between the arches, the gingiva was thicker in the mandibular as compared with the maxillary arch. Since gingival thickness is a significant predictor of the clinical outcome of certain procedures in periodontal surgery, other factors that may influence the thickness of the gingiva such as genetic and racial factors need to be further investigated.

References

- Ainamo, J. & Bay, I. (1975) Problems and proposals for recording gingivitis and plaque. *International Dental Journal* 25, 229–235.
- Anderegg, C. R., Metzler, D. G. & Wicole, B. K. (1995) Gingival thickness in guided tissue regeneration and associated recession at facial furcation defects. *Journal of Periodontology* **66**, 397–402.
- Carlo, B. (1999) Coronally advanced flap procedure for root coverage. Is flap thickness a relevant predictor to achieve root coverage? A – 19 case series. *Journal of Periodontology* **70**, 1077–1084.
- Claffey, N. & Shanley, D. (1986) Relationship of gingival thickness and bleeding to loss of probing attachment in shallow sites following non surgical periodontal therapy. *Journal of Clinical Periodontology* 13, 654–657.
- Daly, C. H. & Wheeler, J. B. (1971) The use of ultrasonic thickness measurement in the clinical evaluation of the oral soft tissues. *International Dental Journal* 21, 418–429.
- Eger, T., Muller, H. P & Heinecke, A. (1996) Ultrasonic determination of gingival thickness, subject variation and influence of tooth

type and clinical features. *Journal of Clinical Periodontology* **23**, 839–845.

- Goaslind, G. D., Robertson, P. B., Mahan, C. J., Morrison, W. W. & Olsson, J. V. (1977) Thickness of facial gingiva. *Journal of Periodontology* 48, 768–771.
- Jan, L. W. (1987) Some periodontal tissue reactions to orthodontic tooth movement in monkey. *Journal of Clinical Periodontology* 14, 121–129.
- Lytle, R. B. (1957) The management of abused oral tissues in complete denture construction. *Journal of Prosthetic Dentistry* **7**, 27–42.
- Muller, H. P. (2000) Masticatory mucosa in subject with different periodontics phenotypes. *Journal of Clinical Periodontology* 27, 621–626.
- Muller, H. P. & Eger, T. (1997) Gingival phenotype in young male adults. *Journal of Clinical Periodontology* 24, 65–71.
- Olsson, M. & Lindhe, J. (1991) Periodontal characteristics in individuals with varying form of the upper central incisors. *Journal* of Clinical Periodontology 18, 78–82.
- Olsson, M., Lindhe, J. & Marinello, C. P. (1993) On relationship between crown form and clinical features of the gingiva in adolescents. *Journal* of Clinical Periodontology **20**, 570–577.
- Ostlund, S. G. (1958) The effect of complete dentures on the gum tissues: a histological and histopathological investigation. *Acta Odontologica Scandinavica* **16**, 1–40.
- Pedelton, E. C. (1934) The minute anatomy of the denture bearing area. *Journal of American Dental Association* 21, 488–504.
- Schluger, S., Yuodelis, R., Page, R. C. & Johnson, R. H. (1990) *Periodontal Diseases*, 3rd edition, p. 561 Philadelphia: Lea and Langer.
- Seibert, J. & Lindhe, J. (1989) Textbook of Clinical Periodontology and Implant Dentistry, 2nd edition, pp. 477–517. Copenhangen: Munksgaard.
- Silness, J. & Loe, H. (1964) Periodontal disease in pregnancy (II). Correlation between oral hygiene and periodontal condition. Acta Odontologica Scandinavica 22, 121–135.
- Terakura, T. (1986) Non invasive thickness measurement of the oral soft tissue. *Journal of Japanese Prosthodont Society* **30**, 1402–1411.
- Uchinda, H., Kobayashi, K. & Nagao, M. (1989) Measurement in vivo of masticatory mucosal thickness with 20 MHz B-mode ultrasonic diagnostic equipment. *Journal of Dental Research* 68, 95–100.
- Van der Velden, U. (1984) Effect of age on the periodontium. *Journal of Clinical Periodontology* **11**, 281–294.
- Waraaswapati, N., Pitiphat, W., Chandrapho, N., Rattanayatikul, C. & Karimbux, K. (2001) The thickness of palatal masticatory mucosa associated with age. *Journal of Periodontology* 72, 1407–1412.

Address:

K. L. Vandana Department of Periodontics College of Dental Sciences Davangere 577 004, Karnataka India E-mail: vanrajs@hotmail.com This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.