

## Original Research Article

### **Cone-Beam Computed Tomographic Evaluation of Morphology and Prevalence Of Palatogingival Grooves For Survival Of Affected Tooth.**

#### **Abstract**

**Background:** Palatogingival groove (PG), a developmental anomaly, originates in cingulum and extends to varying distances apically. It is an ideal pathway for oral bacteria to invade periodontal tissues causing periodontal damage, pulp necrosis, apical periodontitis and endo-periodontal deformity which is not easily perceived until sinus tract infection appears in mouth. Its present a challenge to most clinicians as it requires an interdisciplinary approach to diagnosis and treatment planning.

**Aim and objective:** To evaluate the prevalence and characteristics of palatogingival grooves (PGs) in maxillary anterior teeth on CBCT.

**Material and methods:** CBCT examinations of 707 teeth in 120 patients (Female-41, Male-79) were evaluated retrospectively. Maxillary central incisors, lateral incisors and canine were investigated for the presence or absence of PG and using the Gu classification (type I, II, or III). 3D reconstructed image scans were used for evaluation of PGs. Radiographic features of PGs were noted and differences were evaluated and results were obtained. Differences was considered significant for  $p \leq 0.05$ .

**Results:** The PGs were observed in 61 teeth. Type 1 PG is more prevalent in males (30.37%) than in females (12.19%) followed by type 2 (male-12.65%, females-4.87%) and type 3 (male-3.75%). Higher prevalence for Type 1 PG was seen in the lateral incisor followed by central incisor and canine and had a male predominance. Type 2 PG showed equal prevalence for lateral & central incisor and male predominance. Type 3 PG showed higher prevalence for lateral incisors and male predominance.

**Conclusion:** Prevalence of PGs was found to be 8.62%. PG facilitate bacterial colonization leading to periodontitis, pulp necrosis and endo-periodontal lesion which pose challenges in its diagnosis and an interdisciplinary management for survival of tooth.

**Keywords:** Palatogingival groove, developmental anomaly, Gu classification, Endo-periodontal lesions, CBCT, survival of tooth.

## Introduction

Palatogingival groove (PG) or radicular lingual groove(RG) could be a developmental anomaly during which an infolding of the inner enamel epithelium and Hertwig's epithelial root sheath create a groove that passes from the cingulum of maxillary incisors and extends to varying distances in an apical direction onto the root.<sup>[1,2]</sup> Accurate understanding of the morphology of the root canal system and its variations is very important for favorable endodontic treatment outcomes. Lack of knowledge of the root canal system and its variations may result in failure of endodontic preparation and obturation.<sup>[3, 4]</sup> PG is typically found on the lingual surface of maxillary incisor teeth.<sup>[5-7]</sup> Among the incisors, the maxillary lateral incisors are the foremost commonly affected teeth.<sup>[8,9]</sup>

The groove could also be so deep that a bifurcation and a small additional proximal root is also present. Furthermore, the cemento-enamel junction is irregular and distorted within the region of the groove.<sup>[4]</sup> Different classifications of PGs have been suggested according to their location, origin, and termination. Recently, Gu<sup>[10]</sup> classified PGs into 3 types according to the degree of severity based on micro-computed tomography studies viz type I, type II and type III (Fig 1).

PG is an ideal pathway for oral bacteria to invade periodontal tissues causing periodontal damage, causing pulp necrosis, apical periodontitis and endo-periodontal deformity.. The PGs could manifest as a narrow and localized deep periodontal pocket related to the palatal gingival groove. Usually, this condition is not easily perceived until sinus tract infection appears in the mouth on the labial alveolar mucosa, presenting a dilemma in terms of diagnosis and treatment planning for the most clinicians.<sup>[11]</sup>

Hence, the purpose of this study was to radiographically evaluate the prevalence and characteristics of PGs in maxillary anterior teeth on CBCT.

## Methods and material

The study was conducted in the Department of Oral Medicine and Radiology and the study protocol was approved by the Institutional Ethics Committee (SDKS/PG/STRG/OMR3/Dated 21.12.2020). For this retrospective study, the CBCT scans of anterior maxillary teeth which

were undertaken to evaluate the anterior region for endodontic and surgical intervention purposes were utilized for this study.

Low-quality image scans with scattering or insufficient accuracy of bony borders in the anterior region, errors/distorted images and patient movement artifacts, were excluded. Anterior teeth with dental caries, direct or indirect restorations, rotation, impaction or congenital malformations were also excluded from the study. Evidence of bone disease, skeletal asymmetries or trauma, congenital disorders, or anamnesis of previous surgical procedures and syndromic patients were excluded.

Maxillary central incisors (CI), lateral incisors (LI) and canines (CN) were investigated for the presence or absence of PG and PG type using the Gu classification (type I, II, or III). 3D reconstructed image scans were used for the evaluation of PGs. During the radiographic examinations within the study, the examiners were calibrated to acknowledge PGs and to identify the affected teeth and surrounding structures. The examiners only evaluated the radiographs and were blinded to other patient data during the radiographic examination. Data from CBCT evaluation of 707 teeth (central incisor-231 teeth, lateral incisor – 236 teeth, canine- 240 teeth) was analyzed retrospectively. The final diagnosis and radiographic condition of maxillary anterior teeth was obtained by consensus among the examiners. The data was recorded and analyzed using statistical software “STATA” version 10.1, 2011 (StataCorp LP, Texas, USA).

Descriptive statistics was used to calculate to summarize quantitative variables by mean and variance and qualitative variables by frequency and percentages. Test of significance and p values are used for inferential statistics Differences was considered significant for a value of  $p \leq 0.05$ .

## Results

In present study, 707 teeth in 120 patients (Males-79, Females-41) were evaluated retrospectively. Type 1 PG was found in 24 males and 5 females, Type 2 PG was found in 10 males and 2 females and Type 3 PG was found in only 3 males (Graph 1). Out of total screened teeth, PGs found in 61 teeth. Type 1 PG was found in 38 teeth, Type 2 PG was found in 20 teeth and type 3 was found in 3 teeth (Graph 2).

Type 1 PG is more prevalent in males (30.37%) than in females (12.19%) followed by type 2 (male-12.65%, females-4.87%) and type 3 (male-3.75%). Higher prevalence for Type 1 PG was seen in the lateral incisor followed by central incisor and canine and had a male predominance (Graph 3). Type 2 PG showed equal prevalence for lateral & central incisor and had a male predominance (Graph 4). Type 3 PG showed higher prevalence for lateral incisors and male predominance (Graph 5).

The prevalence was higher in maxillary lateral incisors than in other teeth for both the sexes. For male it was 12.65% and for females it was 9.75%. Two bilateral cases of PGs were found, one in lateral incisor and other in canine. There was no statistical significant difference found between the sex ( $p=0.30$ ).

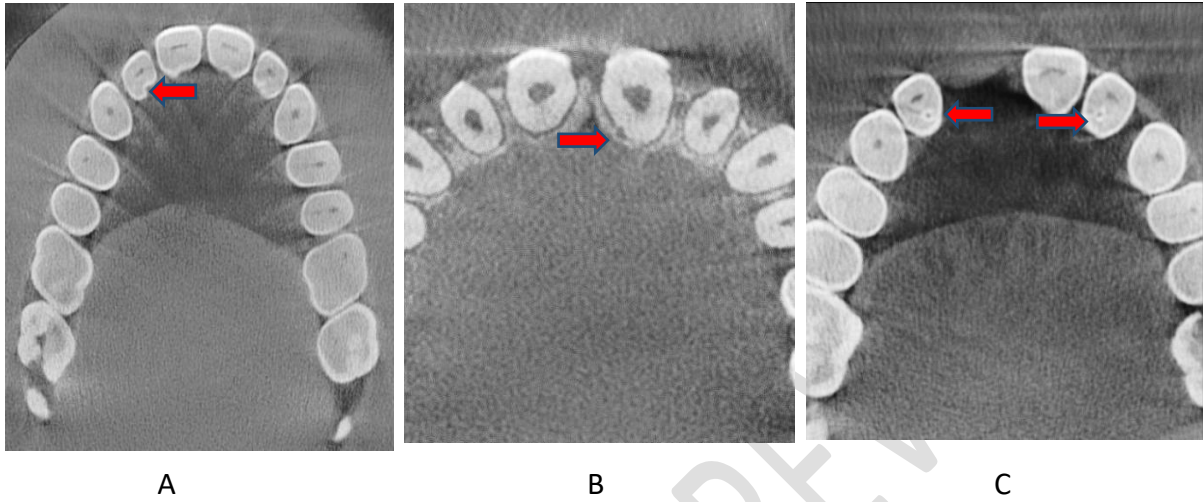
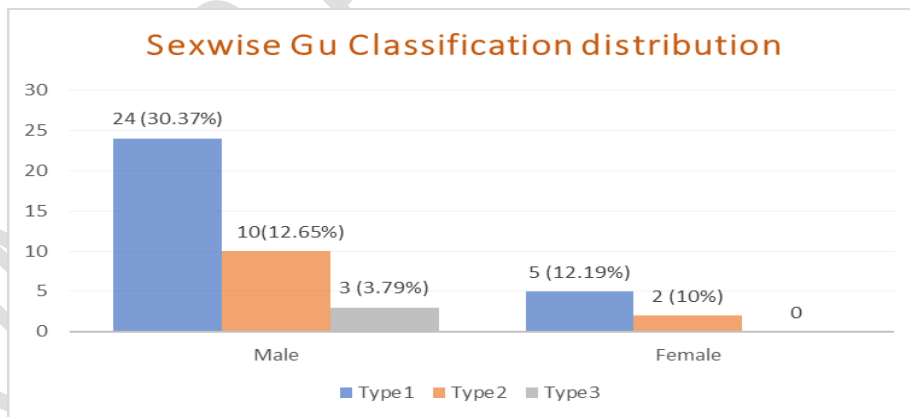
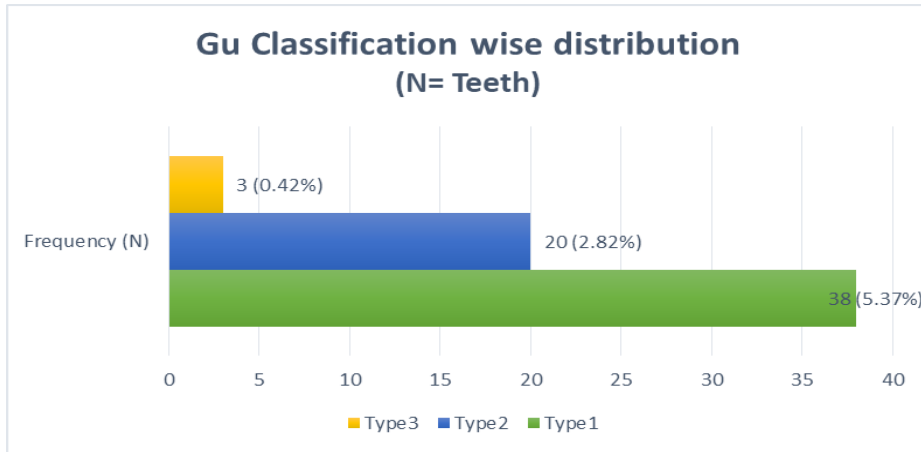


Figure 1: Radiographic image scans showing Gu classification Type 1 (A), Type 2 (B) and type 3 (C).

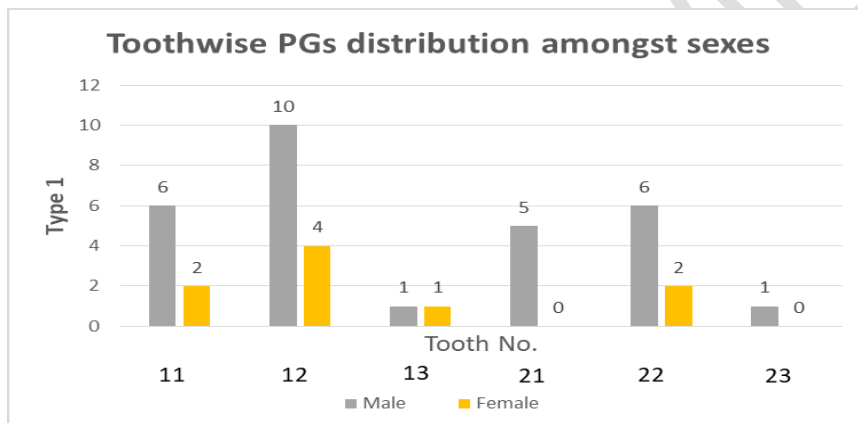
Graph-1: Sex-wise Gu classification distribution of Palatogingival Groove



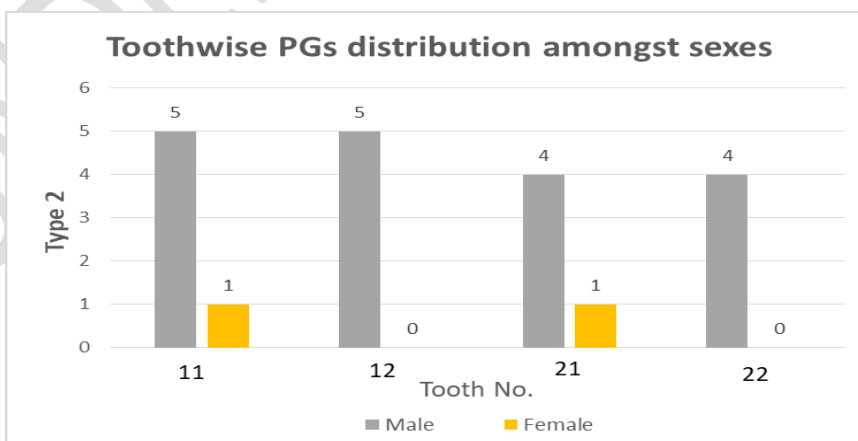
Graph 2: PGs Gu classification distribution in teeth



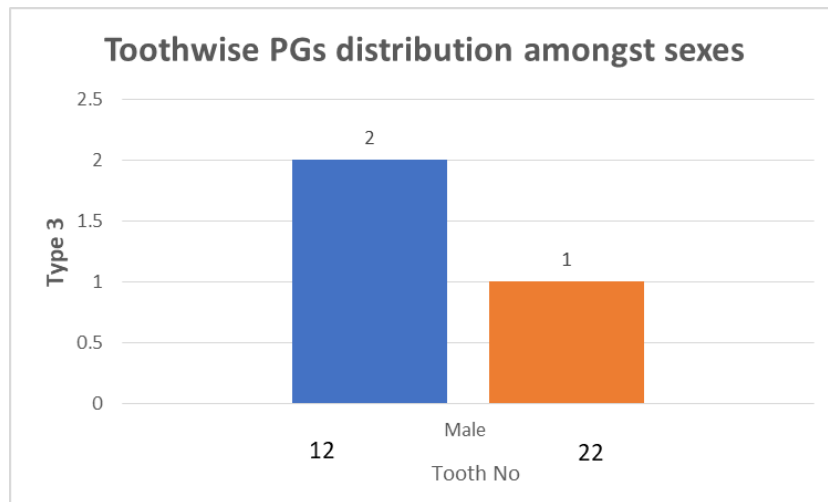
Graph 3: Tooth-wise Type 1 PG distribution amongst the sexes



Graph 4: Tooth-wise Type 2 PG distribution amongst the sexes



Graph 5: Tooth-wise Type 3 PG distribution amongst the sexes



## Discussion

The maxillary anterior region and teeth show various morphologic and anatomic anomalies, including globulomaxillary cysts, cleft palate, congenital absence of tooth, supernumerary tooth, dens invaginatus, Eagle's talon, peg-shaped lateral incisor, germination, fusion, accessory root, and palatogingival grooved incisors.<sup>[5, 6]</sup>

Evaluation of PGs has been performed in vitro using photographs and micro-computed tomography and in vivo using clinical examination.<sup>[12]</sup> Gu et al<sup>[10]</sup> demonstrated that PGs could be detected in axial, coronal and sagittal sections of images, which prompted the detection of PGs using CBCT in this study. Further, it is well established that because of the two-dimensional (2D) nature of conventional periapical radiographic films, inevitable geometric distortion and anatomical noise do not allow accurate examination of tooth and root canal morphology.<sup>[13]</sup> CBCT provides a non-invasive 3 Dimensional examination of morphology of teeth with PGs. Advantage of CBCT is that it can examine both unilateral and bilateral occurrence of PGs in the same patient.<sup>[14]</sup> The focus of this study was to evaluate PGs using CBCT in central Indian population.

A recent study by Arslan et al<sup>[14]</sup> examined CBCT images of 416 patients (age 8–68 years) in a Turkish population and their study reported that the PG incidence in the lateral incisors (2.3%) was higher than the central incisors (0.6%). Prevalence for PGs for male was 6.9% and for female was 1.02% whereas our study shows prevalence of PGs for male is 30.37% and for female 12.19%.

The study conducted by Akshoy et al<sup>[4]</sup> on 191 patients on CBCT in turkey reported only type 1 PGs and prevalence was 4.18% whereas our study shows prevalence 5.37% for type 1.

Everett & Kramer<sup>[15]</sup> and Kogon<sup>[16]</sup> conducted study on extracted teeth and reported PG prevalence 2.8% and 4.6% respectively.

Withers et al<sup>[8]</sup> conducted clinical examination and reported 8.5% PG prevalence and was predominantly found in the maxillary lateral incisors with 93.8% prevalence and clinical

study by Bacic' et al<sup>[9]</sup> divided into two groups comprising young adults (age 20–22 years) and adults with periodontal disease (age 35–50 years) and reported PG incidences of 1.01 and 0.79%, respectively. Pe'cora and da Cruz-Filho<sup>[17]</sup> and Hou and Tsai<sup>[18]</sup> performed clinical examinations and reported of 25 teeth with a PG and prevalence of 44.6% respectively.

The clinical study conducted by Shrestha D et al<sup>[2]</sup> in Nepal on 231 patients. The study reported prevalence for type 1 with female predilection (56.6%) and for male it was 43.3% whereas our study showed prevalence for type 1 with male predilection (30.37%) and for female it was 12.19%.

## Conclusion

Limited data are available in the literature regarding PGs of maxillary anterior teeth using CBCT. This study provides additional information of PGs in maxillary anterior teeth in central Indian population. Type I was the most common PG type. The frequency of PGs was higher in males than in females and was higher in maxillary lateral incisors which was 12.65% for male and 9.75% for female for type 1. Prevalence of PGs in this study found to be 8.62%. As morphology of PGs pose challenges in its diagnosis and treatment to most clinicians, it requires an interdisciplinary approach in the treatment planning. PGs were a relatively infrequent anomaly of teeth in this population, but when present, clinicians should understand the clinical features of these root variations and plan the treatment according to these variations.

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