

# Determining the localization of premolar zenith positions according to the gingival line

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## Abstract

**Background:** The gingival zenith (GZ) positions according to a reference line in the premolar (PM) area remain concern, especially for the clinicians in placing the gingival contours during surgery.

**Objectives:** The objectives of this study are to determine the maxillary PM GZ positions according to GZ line (GZL).

**Materials and Methods:** A sample population of 63 patients with healthy gingival tissue was studied. The GZ was determined at the most apical point of the gingival marginal scallop. A horizontal-zenith line (ZL) was drawn connecting the GZ from the ipsilateral canine (C) and central incisor teeth. Reference lines were drawn, and bilateral measurements were taken in the respective stone casts in the PM area.

**Results:** No statistically significant differences were found between bilateral first premolars (FPM) and second premolars (SPM). When considering ipsilateral FPM and SPM, statistically significant differences were found between them. For all PM teeth, the mean distance value of GZ to GZL was approximately 1.32 mm.

**Conclusions:** The present study results showed that GZs of FPM and SPM teeth for both left and right side was coronally located according to ZL.

**Key words:** Gingival aesthetics, gingival localization, maxillary premolars

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## Introduction

Beauty has been defined as a combination of qualities that give pleasure to the senses or to the mind.<sup>[1]</sup> It is philosophical concepts, which are studied under the term esthetics. Hence, esthetics is the study of beauty, and the human perceptions of facial and dental beauty are important parameters for esthetic appearance.<sup>[2]</sup>

A beautiful smile is indispensable for the face esthetic. Simultaneously, gingival esthetic has always been an important component of a beautiful smile. The appearance of the gingival tissues surrounding the teeth plays an important role in the smile aesthetics of individuals. The lips form the frame of smile and define the esthetic zone. Its position while smiling determines the amount of gingival display. To predict the final esthetic result and achieve

optimal results in gingival contour rehabilitation (crown lengthening, implant, restorative, and orthodontic therapy), it is important to take gingival contours into account during treatment planning.<sup>[3]</sup> Smile esthetics has been widely studied in the field of dentistry.<sup>[4-6]</sup> An important significant feature of the gingival morphology is the gingival zenith (GZ). Because, even with beautifully done restorations, an unattractive GZ position, can negatively affect the smile of a person.<sup>[7]</sup> The GZ is defined as the most apical point of the marginal gingival scallop; in addition, its quantitative orientation in the apico-coronal and mesio-distal directions has been reported.<sup>[1,8,9]</sup> Numerous articles have addressed various aspects-related to gingival contours of the teeth. One significant feature of gingival morphology is the gingival line, which is defined as a line

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joining the tangents of the GZs of the central incisor (CI) and canine.<sup>[10,11]</sup>

Any dental procedure performed in the maxillary anterior and premolar (PM) area can be an esthetic challenge because of the visibility of the dentogingival region.<sup>[12]</sup> Exposed teeth while smiling are an important part of the anatomy of an aesthetic smile.<sup>[13]</sup> As a consequence, variables such as the number of teeth visible in a smile, size, shape, position and color of artificial teeth, as well as margin placement of fixed prostheses must be considered during the construction of prostheses. Specific anatomic relationships should be revealed clearly for better understanding of the clinicians whom studying on maxillary PM zone.

The aim of the present study is to determine the maxillary PMs GZ position according to GZ line (GZL) where to quantify some clinical parameters useful as esthetic guidelines and understanding the GZ will allow clinicians to achieve a more satisfactory esthetic outcome during interdisciplinary diagnosis and treatment.

### Materials and Methods

Ethic Committee approval was taken from the Ondokuz Mayıs University Local Ethical Committee of Medical Research with the decision number of 2009/261.

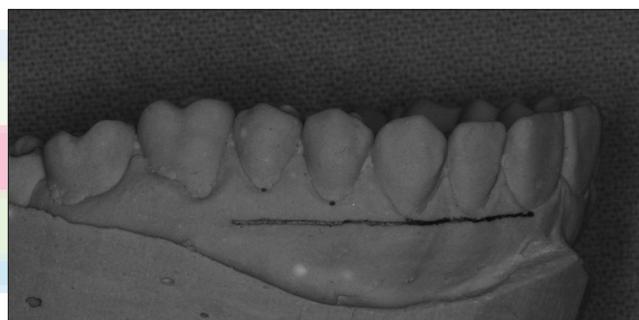
A sample population of 63 patients with healthy gingival tissue was studied. The patients, who ranged in age from 18 to 25 years (mean; 21.35 years), were in good systemic health. Criteria for exclusion in the sample population were restored maxillary anterior and PM teeth, crowding, spacing, gingival recession, gingival overgrowth, periodontal problem, hyperplasia, history of periodontal surgery and orthodontic treatment or altered passive eruption.

Alginate impressions of the study group were made using irreversible hydrocolloid impression material (Cavex, Holland BV, Haarlem, The Netherlands) and were made in stock trays and poured in dental stone (Durguix, Hard Natural Stone, Protechno, Girona, Spain) according to manufacturer's instructions. The GZ was determined at the most apical point of the gingival marginal scallop using an indelible marking pencil for all the maxillary anterior teeth. A horizontal-zenith line (ZL) was drawn connecting the GZ from the ipsilateral C and CI teeth [Figure 1]. Reference lines were drawn, and bilateral measurements were taken in the respective stone casts in the PM area. The distance of first and second PM's (FPM-SPM) zenith position to gingival line was evaluated on the stone cast model using digital Vernier caliper, and the readings were noted as mm. Positive values of the lateral incisor were coronal to the gingival line, whereas negative values were apical to gingival line. Measurements are viewed in Figure 2.

Statistical analyzes were performed by using a statistical program (SPSS 20.0, SPSS Incorporation, Chicago, USA). The Kolmogorov–Smirnov test showed that the data did not show a normal distribution ( $P < 0.05$ ). Data were analyzed using Kruskal–Wallis test, and then Mann–Whitney U-test was used for pair-wise *post-hoc* analyses. Level of significance was set at 5%.

### Results

Significant differences were found among the four teeth group (14, 15, 24, 25) and the median value for all teeth tested was 1.32 mm. When comparing the FPM with SPM according to distance of GZ to ZL, there was statistically difference between groups ( $P < 0.001$ ), and SPM exhibited higher values than FPM. There was no significant difference between bilateral FPM ( $P > 0.05$ ) and SPM ( $P > 0.05$ ) teeth, but there was a significant difference for ipsilateral FPM and SPM ( $P < 0.001$ ). For both left and right side SPM exhibited higher values than FPM. Minimum (min), maximum (max), and median values are shown in Table 1.



**Figure 1:** Drawing the horizontal-zenith line which connects the gingival zenith of canine and central incisor teeth



**Figure 2:** Measurements were performed by digital caliper

**Table 1: Descriptive values for premolars tested**

Measuring sites	Minimum	Maximum	Median	Mean	SD
FPM - Right	-0.73	4.62	1.15	1.20	0.11
SPM - Right	-0.23	6.59	1.80	1.90	0.16
FPM - Left	-0.10	4.51	1.09	1.20	0.95
SPM - Left	-0.21	5.02	1.70	1.80	0.14

\*Different letters indicate statistically significant difference. SD=Standard deviation; FPM=First premolars; SPM=Second premolars

## Discussion

In the present study, maxillar, PM GZ positions were evaluated by referring the ZL that connects the zenith points of C and CI teeth. Elements involved in designing an esthetic smile have been profoundly discussed in the dental literature.<sup>[4-6,11]</sup>

Now it is known that smile line and gum visibility are valid tools to assess the esthetic appearance of a smile.<sup>[14]</sup> In addition to this, posterior gummy smile plays an important part in perceived smile esthetics.<sup>[15]</sup>

Aesthetic considerations in smile design have focused mainly on the anterior teeth region and in parallel to this, Chu *et al.* concluded that the GZL in an AC direction of lateral incisors relative to the gingival tangential zenith line joining adjacent CI and canine was approximately 1 mm under healthy conditions<sup>[9]</sup> and Hochman *et al.*<sup>[3]</sup> concluded that the importance of maxillary anterior dental papillae display during dynamic smiling should not be left undiagnosed. However, many subjects may display PMs or even first and second molars as well<sup>[16]</sup> and in parallel to this, Kapagiannidis *et al.*<sup>[12]</sup> evaluated frequency of tooth and gingival display in the PM region. They concluded that greater amounts of gingival display were present in the maxillary PM area compared with both CIs and canines. First and second maxillary PMs were partially visible in over 80% of the recorded smiles<sup>[12]</sup> and it is known that gingival display negatively influenced the perception of smile attractiveness.<sup>[17]</sup> Although until 6 mm of posterior gum exposure was considered esthetically acceptable according to Rodríguez-Martínez *et al.*,<sup>[15]</sup> it was important to determine the precise locations of both FPM-SPM teeth according to a reference line. Considering these in the present study, the distance of FPM-SPM zenith positions to gingival line was evaluated on the stone cast model using digital Vernier caliper. Although highly sensitive photographic method could be used for measurements,<sup>[18]</sup> it was avoided as it converts the cast into a two-dimensional structure and flattens the relation of GZs and ZL. The present study results showed that GZs of FPM teeth for both left and right sight was coronally located according to ZL and the distance had a mean value of 1.20 mm. For both left and right SPM teeth, the same distance had a mean value of 1.80 mm and 1.90 mm, respectively.

With other objectives and subjective parameters about smile esthetic, the findings of the present study could be used by clinicians in placing the gingival contours during surgery,

especially for the most complex situations, like interdisciplinary management of both anterior and posterior esthetics.

## Conclusion

The present study results showed that GZs of FPM and SPM teeth for both left and right sight was coronally located according to ZL.

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