

Quantitative Evaluation of Spatial Migration in the Gingival Zenith Point Among Maxillary Anteriors

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ABSTRACT

Background: Gingival zenith is the most apical point on the marginal gingival scallop and an important landmark described as having a specific spatial orientation in the apico-coronal and mesio-distal direction. Gingival health is among the first fundamental aesthetics objectives during treatment planning. The knowledge regarding the quantitative value of the gingival zenith position of maxillary anterior teeth which is the most esthetic zone will be beneficial during treatment procedures like crown lengthening, restoration, prosthetic replacement and also during orthodontic treatments.

Materials and methods: A total of 360 sites in 30 healthy subjects were evaluated. Bilateral gingival zenith measurements were carried on the maxillary impression stone cast. Canine, lateral incisor and central incisor were evaluated for the mesio-distal displacement of gingival zenith in relation to the long axis of crowns. Apico-coronal displacement of the gingival zenith of the lateral incisor concerning the central incisor and canine teeth was also recorded. **Statistical analysis:** Commercially available statistical software (SPSS version 11.5) was used to analyze the data.

Result: Distal displacement of gingival zenith was between 0.26 to 1.01 mm in 90%, 85% and 60% of the central incisors, lateral incisors, and canines, respectively. The gingival zenith's mesial position in relation to the long axis of the crown was not observed in any tooth, regardless of the tooth group.

Conclusion: The frequency and magnitude of distal displacement are tooth-dependent and larger in central than in lateral incisors, which in turn, is larger than in canines.

Keywords: Gingival Zenith, VBM, GZL, GZP.

INTRODUCTION

Gingival zenith is the most apical point on the marginal gingival scallop. It is a vital landmark delineated as having a specific orientation within the apico-coronal and mesio-distal direction. Gingival health is among the primary elementary

aesthetic objectives throughout treatment planning. It is also important to consider gingival morphology and contour in various procedures like crown lengthening, smile designing¹. The gingival line is outlined as the line joining the tangent of the

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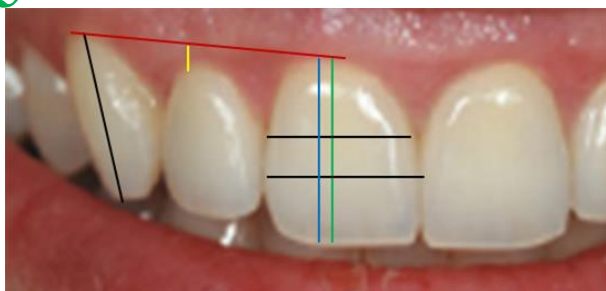


Fig 1: a) Horizontal line(Red line)- connecting the GZ from the ipsilateral Canine and Central incisors b)Vertical line (LA)(Green line)- bisecting the midline of the maximum crown width c) GZ-LA distance(blue line) - discrepancy between gingival zenith and the long axis of the tooth.



Fig 2: Digital Caliper for measurements.

gingival zenith of central incisor and canine. The clinical significance of gingival zenith positions in maxillary anterior teeth is during the crown lengthening and root coverage procedures. It is also considered during implant placement, orthodontic treatments. It will greatly influence the emergence profile and axial inclination of a tooth when the gingival contour is changed according to the long axis of the crown. So the aim of the study was quantitative measurements of deviation in gingival zenith position (GZP) from the vertical bisected midline (VBM) drawn along the long axis of each maxillary anterior tooth and The difference in the measurement of gingival zenith level (GZL) of the lateral incisors compared with that of adjacent central incisor and canine under healthy conditions

MATERIAL AND METHODS

A total of 30 subjects (22 females and 8 males) included in the study. The individuals, with age

group ranging from 20 to 26 years (mean 23 years) and having healthy systemic and periodontal conditions were included in the study

Inclusion criteria

- Subjects older than 20 years (where gingival margin on the facial aspect of maxillary anterior teeth is placed apical to the cervical bulge)
- Subjects with healthy periodontal condition i.e. absence of bleeding on probing, probing depth <3 mm, absence of gingival recession
- Gingival margin should be healthy representing normal color, contour, and consistency

Exclusion criteria

- Subjects taking medications known to influence gingival contour and consistency were excluded.
- Individuals with gingival alterations such as gingival overgrowth or hyperplasia, inflammation, altered passive eruption and attachment loss
- History of periodontal therapy
- Restorations in anterior maxillary sextant
- History of dental trauma in the anterior dentition
- Evidence of physiologic occlusion wear ≥ 1 mm
- History of orthodontic treatment

Morpho-metric analysis

Alginate impressions of the maxillary dentition from the test group were taken with the irreversible hydrocolloid impression material and immediately poured with dental stone. Reference lines were drawn on the canine(C), lateral incisor (LI), central incisor teeth (CI) and bilateral measurements were taken in respective stone casts. GZ point was determined at the most apical point on the scalloped gingival margin. To measure the VBM on each clinical tooth crown structure, the tooth width was calculated at two reference points. These two reference points were marked, one at the coronal contact area position and other at the apical contact area position.

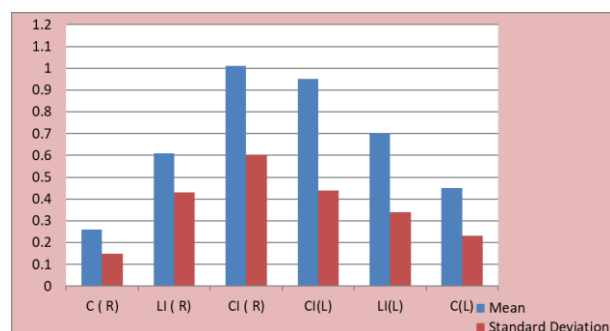
LI-GZ distance (yellow line) was defined as the vertical discrepancy between the zenith level between central incisor and canine and the zenith of

Table 1: Distance of gingival zenith position (mm) distal to the vertical bisected midline of the clinical crown along the long axis of the tooth.

TOOTH GROUP	N	MEAN $\pm$ SD	MINIMUM	MAXIMUM
CETRAL INCISOR (R)	30	1.01 $\pm$ 0.6	0.0	2.5
CETRAL INCISOR (L)	30	0.95 $\pm$ 0.44	0.0	1.7
LATERAL INCISOR (R)	30	0.61 $\pm$ 0.43	0.0	1.6
LATERAL INCISOR (L)	30	0.70 $\pm$ 0.34	0.0	1.7
CANINE(R)	30	0.26 $\pm$ 0.15	0.0	1.02
CANINE(L)	30	0.45 $\pm$ 0.23	0.0	1.1

Table 2: Distance of the gingival zenith level (mm) of the lateral incisors (li) in an apicocoronal direction relative to the gingival line, joining the tangents of the gingival zenith position of the adjacent central incisor and canine teeth.

TOOTH GROUP	N	MEAN $\pm$ SD	MINIMUM	MAXIMUM
LATERAL INCISOR (R)	30	0.94 $\pm$ 0.49	0	1.8
LATERAL INCISOR (L)	30	0.95 $\pm$ 0.46	0	1.6



Graph 1: showing variation in means and standard deviation in central incisor, lateral incisor and canine

ipsilateral LI. Whenever these distances were <0.1 mm, the respective landmarks were considered. All measurements were performed under direct light with a digital caliper with a resolution of 0.01 mm. Measurements were recorded to nearest $1/100^{\text{th}}$ mm.

Statistical analysis:

Commercially available statistical software (SPSS version 11.5, SPSS) was used for the analysis of the

data. Inter measurement differences were analyzed with the paired-t-test. P-value <0.05 was considered statistically significant.

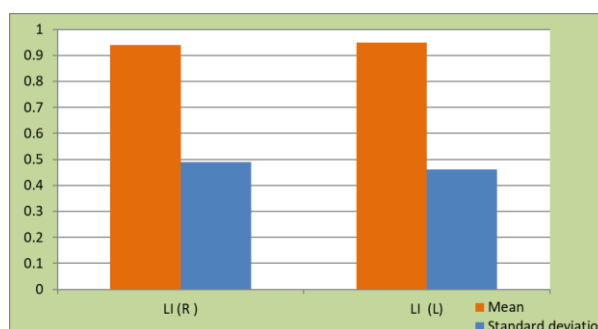


Fig 2: Distance of the gingival zenith level (mm) of the lateral incisors (li) in an apicocoronal direction relative to the gingival line, joining the tangents of the gingival zenith position of the adjacent central incisor and canine teeth.

RESULT

Contra-lateral comparisons between the tooth groups revealed a significantly larger distal displacement of the zenith in the left canine

($p < 0.05$). Ipsilateral comparisons revealed that the lateral displacement of the zenith was significantly larger in central than in lateral incisors ($p < 0.05$). Similarly, the zenith of lateral incisors was displaced significantly more distal than that of canine teeth ($p < 0.05$). Comparisons revealed that the frequency of coincidence in the position of the gingival zenith with the long axis of the tooth revealed that it was significantly greater in canines than in lateral and central incisors ($p < 0.05$).

The mesial displacement of the gingival zenith was not observed with the long axis of any tooth, which was considered in the study. The mean distance of the gingival zenith level (GZL) of the lateral incisor which was measured in an apico-coronal direction of the gingival margin was relative to the gingival line joining the divergence of the adjacent central incisor and canine (approximately 1mm). The range of values measured was 0 to 1.8 mm

The gingival zenith was distally displaced between 0.26 to 1.01 mm in 90%, 85% and 60% of the right central incisors, lateral incisors, and canines, respectively. Mesial displacement of the gingival zenith about the long axis of the crown wasn't observed in any tooth, regardless of the tooth group. The opposite side comparisons between the tooth groups revealed significantly larger distal displacement of the zenith in left canine ($p < 0.05$).

DISCUSSION

The anatomic gingival structure is described as a scalloped contour that surrounds the necks of teeth. The scallop of gingiva is following the course of cement-enamel junctions which gives enormous influence on the aesthetics of a smile. Gingival zeniths are nothing but the most apical position on the cervical portion of the tooth where scalloped gingiva is present. It is used as a reference point for periodontal crown lengthening or root coverage procedures¹. They can also be used during orthodontic treatment for placement of brackets². So this is the important landmark which is having a specific orientation in apico-coronal and in mesiodistal directions. It provides us a guideline to achieve the desired axial inclination by making changes in the line angel positions of teeth. Our study was designed for quantitative measurement of relative displacement of gingival zenith positions in the maxillary anterior region.

The result of measurable evaluation revealed that the distal displacement of the zenith was not a universal finding in the anterior maxillary dentition. In the present study, the data reveals that distal displacement of the zenith was frequent in central incisors which are 1.01mm on right and 0.95mm on the left side. A similar distal displacement of central incisors was found in the study Chu et al.² and Zagar et al.³

In this study when the lateral incisors were considered, they showed distal displacement of GZP on both right and left side which is 0.6mm and 0.7mm respectively. The similar results were found in the study conducted by Rufenacht et al⁴ but in the study done by Rathod et al⁵ they found that GZP of lateral incisors coincides with the long axis of the tooth. Whereas opposite side comparisons did not reveal significant differences between the tooth groups (except for the canines, $p < 0.05$), thus demonstrating contra lateral symmetry for the distal displacement of the gingival margin.

Gingival zenith point measured with the canine and the mean value which was found was 0.2 mm on right and 0.4mm on the left side from the long axis of the tooth. This finding showed that in canines GZP was in close approximation to the long axis of a tooth which was closely related to the study conducted by Zagar et al³ which found that GZP coincides with the long axis of the tooth. These findings were not as per the study performed by Rufenacht et al⁴ and Mattos et al⁶ which showed the distal displacement of zenith with the canine.

Comparisons of GZP on the right and left side showed that there was slight variation in the position of gingival zenith but to summarize the gingival zenith position in central incisors and lateral incisors was distally placed. In canines, it was in close approximation to the long axis of the tooth but on the distal side. Mesial migration of GZP was not observed in any of the teeth considered in the study.

CONCLUSION

Gingival zenith position is an important landmark when aesthetics is a major concern during treatment. By following this path maximum aesthetics can be achieved in various surgical or nonsurgical procedures.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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